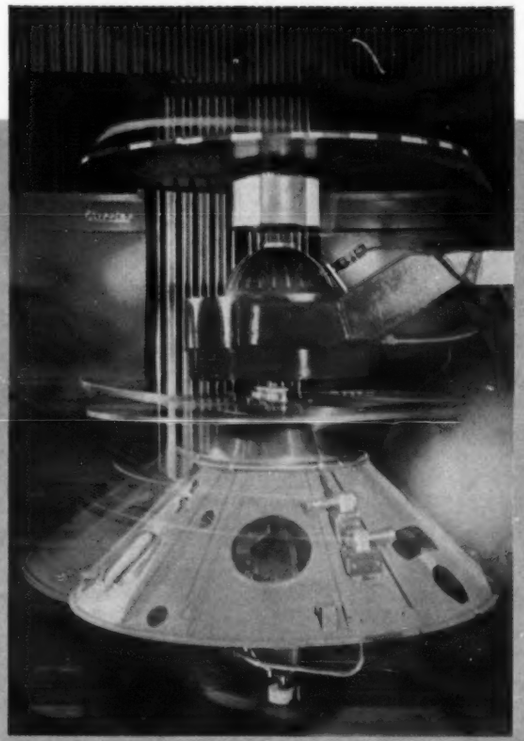
Design News



Bowling ball
serves as
air-bearing journal
in Discoverer spin tests.
Page 10

A CAHNERS PUBLICATION

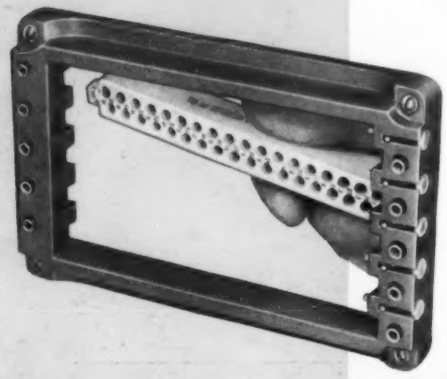
MAY 22, 1961

packaging flexibility...

BURNDY MODULAR HYFEN

electrical connectors

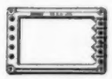
for single conductor, miniature and standard coax cables



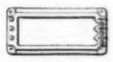
ALL CONTACTS CRIMP-TYPE SNAP-LOCKED

1 SELECT FRAME AND ADD INSERTS

Choice of 3, 5, 8, and 12 insert high strength metal frames. Inserts are high dielectric glass-filled molded material with excellent insulation characteristics. Metal ferrules molded in permit frequent insertion and removal of contacts without loss of contact retention force. Inserts may be mounted from front or rear of mounting panel. Jack screws fasten plug to frame, providing necessary engaging forces.

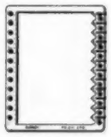


for 5 inserts

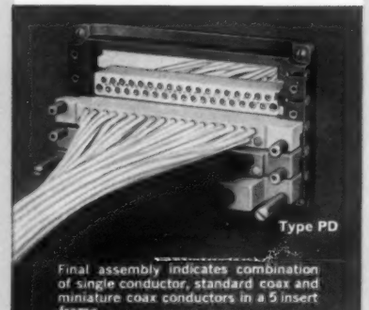


for 3 inserts

for 8 inserts



for 12 inserts



Type PD

Final assembly indicates combination of single conductor, standard coax and miniature coax conductors in a 5 insert frame.

2 COMPLETE ASSEMBLY

Pins and sockets, interchangeable in plug and receptacle, may be inserted before or after inserts are in place. Inserts accommodate 35 single conductor contacts, 21 miniature coax contacts, or 10 standard coax contacts. All contacts are completely crimp-type assuring high reliability of tool-controlled installations. Contacts are individually removable, providing versatility of gang or individual connect and disconnect.

For complete engineering and specification details on the MODULAR HYFEN and other Burndy connectors for electronic use contact OMATON DIVISION

BURNDY

61-7

NORWALK, CONNECT. BICC—BURNDY Ltd. Prescot, Lancs., England In Continental Europe: Antwerp, Belgium TORONTO, CANADA

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Vol. 16 No. 11
Worldwide Coverage of Technical

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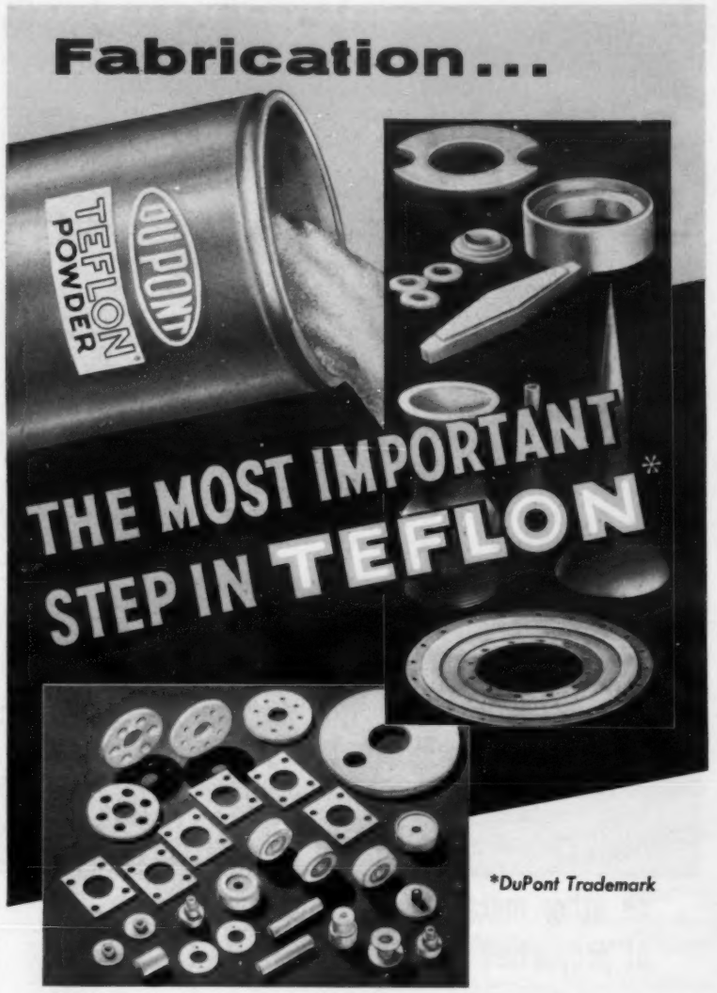

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For instance, Crane Packing Company's new Teflon products plant was especially designed to obtain the highest quality fabrication of this material and includes the very latest in extruding, molding, curing and machining equipment. In critical areas, air is filtered to eliminate impurities, and climate is scientifically controlled to maintain proper density piece after piece. Result: *parts and components that retain all of Teflon's outstanding electrical, mechanical, anti-corrosive, heat-resistant and other properties.*

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CRANE PACKING COMPANY

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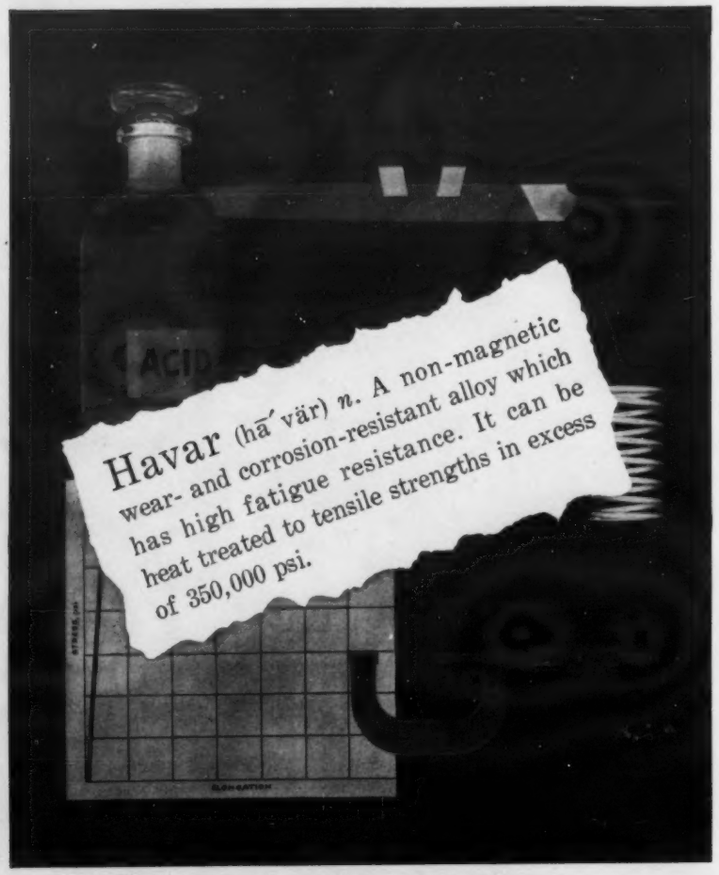
Havar (hā′ vär) n. A non-magnetic wear- and corrosion-resistant alloy which has high fatigue resistance. It can be heat treated to tensile strengths in excess of 350,000 psi.

no other metal has the combination of properties found in new HAVAR

Designers looking for a new and versatile metal are finding practical answers in the unique properties of Havar. This unusual material is a corrosion-resistant, non-magnetic alloy with high fatigue resistance and high tensile strength. It possesses exceptionally high resistance to permanent deformation, thus permitting a more constant delivery of torque over extended periods.

New Havar is being used for critical springs and process control diaphragms, torque control drive bands, electronic computers and—because of its ductility and corrosion resistance—for orthodontic wire.

Havar was developed by the Metals and Electronics Division of Hamilton Watch Company. It is presently available in bars, wire, strip and in foil in thicknesses down to 0.0001" at tolerances closer than you can imagine.

Write today for complete data on engineering properties and processing instructions. Ask for the Havar Technical Data Sheet—or for a sample of Havar. Dept. DN-5.

HAMILTON

WATCH COMPANY / **Metals and Electronics Division**

Lancaster, Pennsylvania

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SOUNDING BOARD

FOR OUR READERS

Spare Parts, Reliability—or Low Bid

The article, "Spare Parts, Reliability—or Low Bid", by your Mr. Schrader in the Jan. 16, 1961, issue is most commendable. There is ample evidence that even with the most careful component-part vendor selection and tight reliability specifications, prime contractors working on complex weapons systems cannot buy parts with sufficient life expectancy to satisfy the desired MTBF rates on the systems they build for military use. . . .

A large capital investment and a great deal of time and money are required to prove component-part reliability (life expectancy). It is a task far beyond the capability of small business operations for many reasons. . . .

DANA A. GRIFFIN, Mgr.
Reliability Assurance Equipment
The Daven Co.

We have just read your piece, "Spare Parts, Reliability—or Low Bid," which appeared in DESIGN NEWS Jan. 16, as well as several letters which appeared in the April 10 issue. Very interesting reading.

Part vendors have on occasion left themselves open to the accusation of "immoral thievery" in quoting prices on drawings. We have seen outrageous drafting salaries, overhead rates, burdens, general and administration fees, reproduction costs and phony arithmetic. We have been held up for "proprietary data costs" on parts which were designed to our specifications. We have been billed for horrendous contingencies merely because MIL-D-70327 was mentioned in the boiler plate. Our requests for quotes on drawings have been ignored and our follow-up snubbed by vendors who will snap up a parts order with great alacrity.

Design contractors are caught in a difficult squeeze between a customer and vendors, not to mention subvendors, sub-subvendors, etc. The result is unbelieveable delay and expense in the copmpletion of drawing requirements.

D. P. SIMONTON, Manager
Design Support Services
RCA, Van Nuys, Calif.

Tempered Glass

Re "Tempered Glass", Sounding Board, March 27, 1961. I always thought that tempered glass was a good thing on cars, except for the windshield. It is undesirable then, since it might craze to opaqueness as a result of a flying stone.

Certainly I'd rather break out of a wrecked car with jammed windows by smashing tempered glass than by trying to smash the laminated construction.

My Porsche has a laminated windshield and tempered glass elsewhere. The owner's handbook discusses the consideration that I raised above.

I've always wondered if it was possible for independent dealers to cut and fit tempered safety glass. This may possibly be a consideration in the distaste for this excellent material expressed by Mr. Turnbull of the L.S.G.C. of the N.A.&F.G.D.A. I wonder if Mr. Turnbull has ever tried to extricate somebody halfway through some laminated glass?

N. MONSARRAT
Manager, Ordnance Dept.
The Leesona Corp.
Providence, R. I.

Dimensioning System

I have read your Jan. 2 issue and appreciate your recognition of the advance in automation and machine controls. In respect to numerically controlled equipment, I feel your greatest contribution this year can be made in emphasizing a good dimensioning system. Not only the stackup of tolerances but the basic dimension system must be changed to suit this new application of numbers.

I would appreciate your efforts in behalf of the manufacturing personnel.

R. W. MILLER
Mfg. Engineer
General Electric Co.

Hydrofoil Craft

It was interesting to read about the Grumman Aircraft Co.'s work on hydrofoil craft. There are a number of such craft in actual operation in Italy and an Italian hydrocraft is in ferry service in northwest U.S.A.

I have heard of Alexander Graham Bell's work on hydrofoil craft . . . Bell seemed to be interested in everything including airplanes and hydrofoil boats. In 1919, on Bras d'Or lake in Cape Breton Island he had an 80-ft-long craft up to 78 mph. The U.S. government loaned him two Liberty engines which drove air propellers. At the Baddeck museum there are models of this craft and pictures of it at high speed on the lake. It must have been easy to control since he was 72 years old and operated the controls himself. He even allowed his wife to take the controls. . . .

CASPER J. BOWMAN
Northport, N. Y.

Freedom of the Press

The local newspaper carries a complete map and description of a Titan underground complex. The latest Astronaut shot is photographed, televised and reported for all the world to see. A movie newsreel shows the latest failure of an ICBM. A major news magazine describes in detail, and comments upon, the Cuban fiasco.

Turn to any news medium these days and you will find grist for the Soviet intelligence mill. We tell the world everything we are doing and why. We even tell them where—and in the words of the military—in what strength.

Who is to blame for this appalling lack of security? Some are quick to blame the press, radio and TV. Some people blame spies and all kinds of undercover agents working for the other side.

Obviously our news media are partially to blame. A newspaper man or a commentator is very prone to forget the security aspects of the hot story which presently concerns him. But the fault is not altogether his.

Somebody, or some agency or some group had to feed this information to him in the first place. Why, for instance, do we allow such items as military transfers, maps of installation and similar security information to reach our news media through the news releases pouring out of government agencies? Why do we announce to the world when a missile has failed? Why is everyone informed on the productive capacity of our major industrial plants?

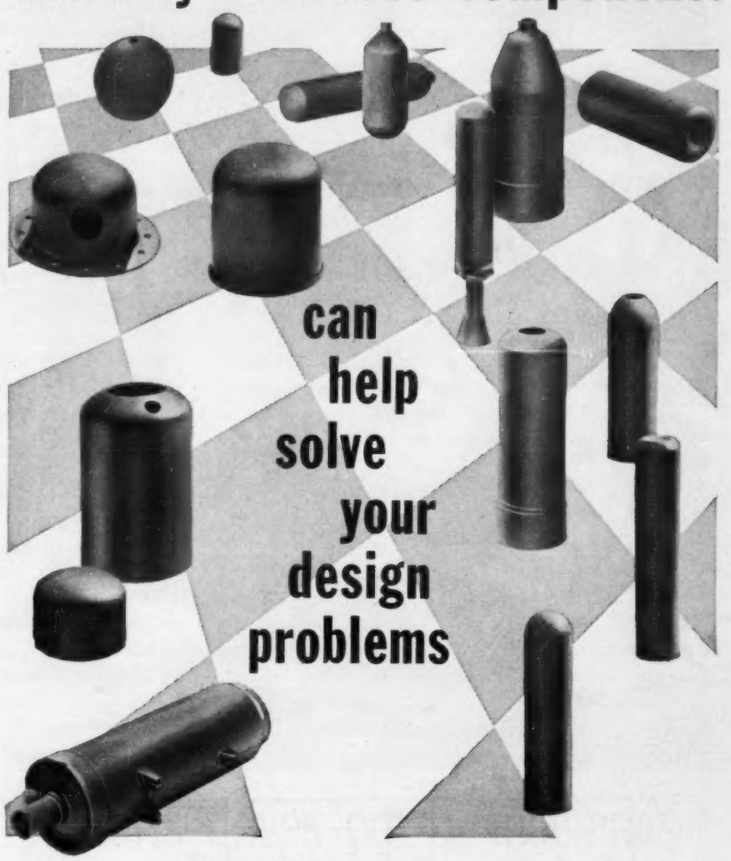
I am sure the American people are smart enough to know that freedom of the press does not necessarily mean a total lack of security. The fact is we have not grown up. It is time we realized we are in a war which is a life and death struggle for us all. If we are to continue giving the enemy our innermost secrets on the front pages of our newspapers and on our TV screens and in national magazines we are facing certain annihilation.

The President has asked the press to provide its own security. Personally, I am afraid that it will take far more than this. Let's also place a muzzle on congressional hearings—on loose talk at the local bar—on government bureaucracy—and on some of our military commanders as well. It is time to put away childish things. Our very life depends on it.

J. P. Peters

Executive Editor

Hackney seamless components



Whatever your shape or shell problem, the solution lies in Hackney deep drawn forming methods. There are two good reasons why:

First, Hackney components are produced the cold drawn way to insure strong, lightweight, seamless shells with smooth, clean surfaces; consistently uniform side walls, and closely controlled tolerances. That's what makes them completely dependable, completely reliable parts of your design.

Second, many of the sizes you need are quickly available because we have a large assortment of dies, mandrels and related tooling. And our experience and facilities are at your disposal to transform any of your design ideas into reality.

Why not let our engineers help you work out details and suggest ways to improve reliability and reduce costs. Your components can be formed in steel, magnesium, nickel, ultra-high-strength stainless steels, hot work tool steels, molybdenum or titanium. Units can be made in sizes from 1 qt. to 100 gal.; diameters range from 2″ to 32″; lengths may be from ½ to 5 times the diameter, or up to 110″. For complete information, write to the address below.

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DESIGN ENGINEERING NEWS

Fiber-Metal Mats Reinforce Brazed Joints

Lars G. Soderholm, Midwest Editor

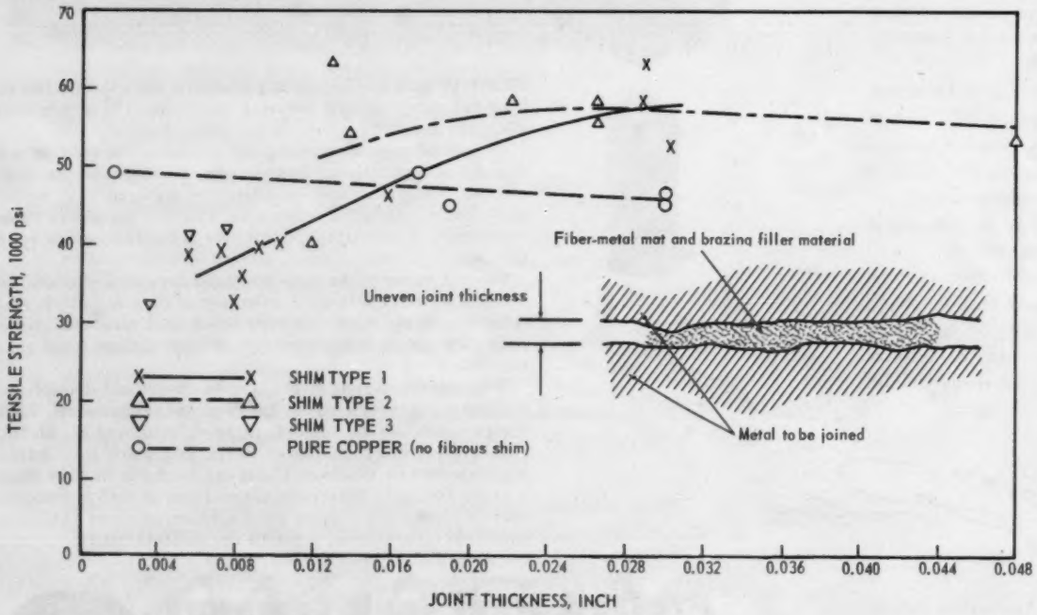
CHICAGO, ILL.—A new brazing process makes use of fiber-metal mats infused with a brazing filler metal. The mat is placed in the joint to be brazed, which then is heated to over the filler melting point. Capillarity of the mat permits large spacings to be used with increased tolerance to mismatch and misregister.

The fiber-metal mats are made by suspending short metal fibers in glycerine and then felting them. They can be pressed, rolled and sintered to provide a porous metal carrier for the filler metal. Both base and filler metal fibers can be used together, if desired.

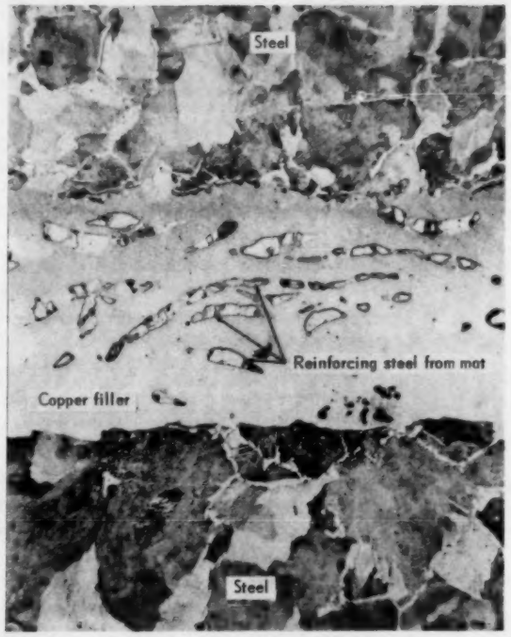
Advantages of this brazing system are: greater strength at thick joints or in illmatched surfaces because of the reinforcing effect of the fiber mat in the filler metal (similar to reinforcing bars in concrete); ability to hold filler metal where needed because of blotter effect of fiber mat, and availability of a wide range of possible characteristics by varying composition and ratio of fiber-metal mat to filler material.

Another advantage, particularly important in the brazing of refractory metals, is the ease of interdiffusion of filler metal and base metal to provide a higher remelt temperature than the original brazing temperature. In a conventional brazed joint this is quite time-consuming. In the fiber-metal brazed joint, however, the fibers act as a highly efficient diffusion sink with a high surface-to-volume ratio so the remelt temperature can be raised in a short time.

The fiber-metal shim-brazing process was developed at the Armour Research Foundation in work performed by H. Schwartzbart and R. Nolen for the Association of American Railroads.



TENSILE STRENGTH VERSUS JOINT THICKNESS of butt-brazed joints in mild steel. Three fiber-metal shims and a copper-only joint are compared. Type 1 shim has copper-to-steel ratio of 2:1 and 0.020-inch shim thickness. Type 2 shim has 1:1 copper-to-steel ratio and is 0.019 inch thick. Type 3 shim has 1:1 copper-to-steel ratio and is 0.005 inch thick. As joint thickness increases, strength of fiber-metal joints also increases.



FIBER-METAL BRAZED JOINT at 250 times magnification reveals microstructure in which copper filler material is shown between two pieces of mild steel. Reinforcing steel from fiber mat is shown throughout brazed section of joint.

Film Master Speeds

Victor W. Wigotsky, Eastern Editor

GARDEN CITY, LONG ISLAND, N. Y.—A fast method of making reproducible procurement drawings from catalog information has been devised with the use of a copying machine.

A paste-up of the illustration from the manufacturer's catalog is made on company drawing format (A). The format paper is then printed on transparent matte film and additional notes, numbers and titles are added. This becomes the drawing master (B). Any number of prints may then be made (C) and the film master is filed for future use. Processing time takes less than five minutes and

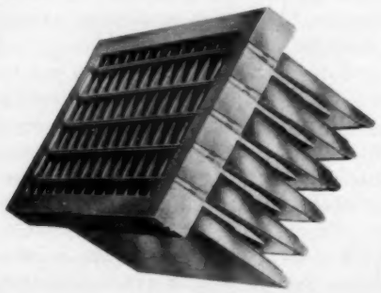
Flexible Blades Cut Losses in Air Valve

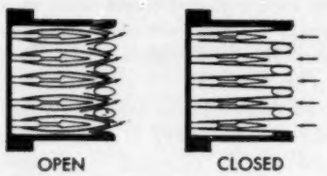
Ronald W. E. Martin, British Editor

LONDON, ENGLAND—Flexible sealing blades of a valve move across the air flow in a manner which causes no change of direction in the flow. Losses in the valve are therefore said to be low.

Blades do not move bodily to open the valve, but roll back from a fixed edge. This produces smooth and progressive opening and closing.

The direct air flow valve is a development of Alan Muntz and Co., Ltd. In addition to their use in compressors, the valves are also suitable for use in two-stroke engines where quick-acting check valves are required.



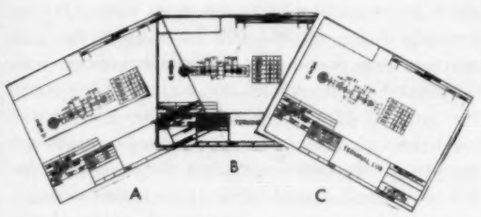


DIAGRAMS show air passing through blades which have bent back to provide smooth passage; if air flow reverses, blades return to their seats and seal.

Reproduction of Drawings

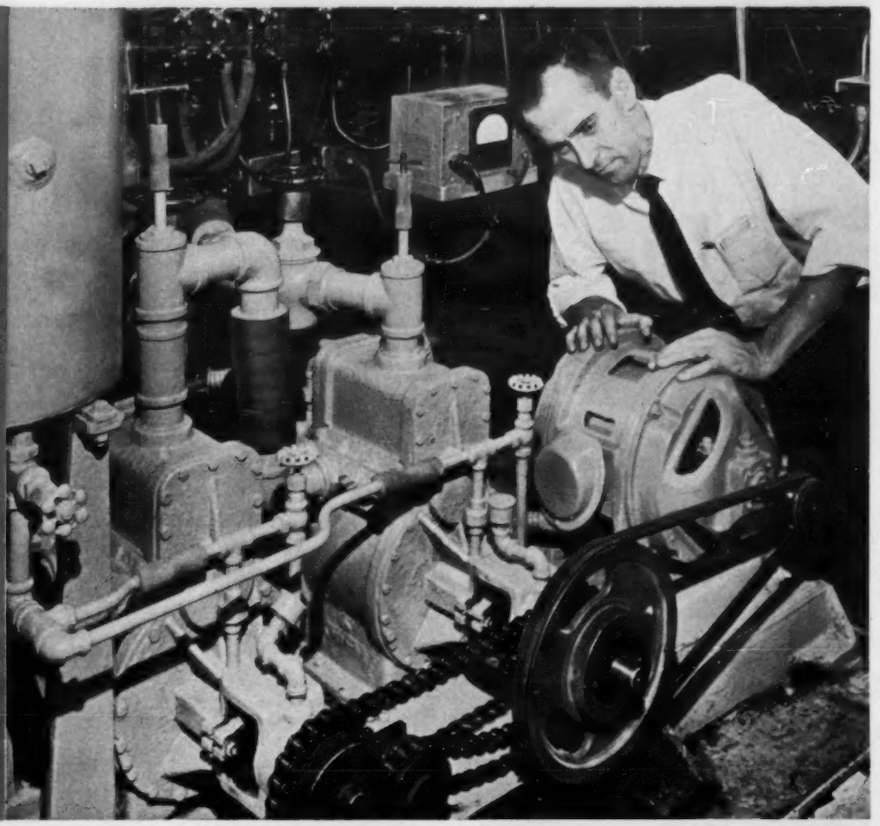
material costs are less than $0.50.

Reeves Instrument Corp. announces use of the time-saving method of making some of its component drawings of commercial items.



Exclusive design features include: precisely engineered arched top, concave sidewalls, Flex-Weave cover, super strength tensile construction.

Super HC Drives for 45 vacuum pumps on lamp production units at the Westinghouse Trenton, N. J. plant are saving over $1,000 a year in belt replacement costs.



Westinghouse converts drives on 45 machines to new Gates Super HC High Capacity V-Belts

When drive space is limited, a driver sheave too small in diameter is sometimes used—though not recommended. Constant flexing over a small sheave is severe punishment for V-belts. Because of this, conventional V-belts lasted 4 months or less on the vacuum pumps on lamp production units at the Westinghouse Lamp Division plant in Trenton, N.J.

Now, with space-saving Gates Super HC High Capacity V-Belt Drives on all 45 machines, all belts are still running strong after more than 1½ years . . . a saving of over $1,000 in belt replacement costs plus even greater savings through reduced down-time.

The Gates Super High Capacity V-Belt is a new concept in V-belt design.

It is industry's first and most advanced high capacity V-belt. Because of exclusive design features, Gates Super High Capacity V-Belts transmit up to 3 times more horsepower than conventional V-belts in the same space. Or the same power can be handled with fewer belts and smaller sheaves in less space.

As a result, Gates Super HC Drives save up to 50% in drive space . . . cut your drive costs as much as 20% . . . reduce drive weight 20% and more . . . and make possible further savings in material costs.

Your local Gates Field Engineer is an experienced, fully-qualified drive design expert. Contact him for Super HC design information and for design help.

Building the future on 50 years of progress

The Gates Rubber Company, Denver, Colorado BP4D

Gates Super HC V-Belt Drives

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Here are some examples of unusual applications for high alumina and steatite ceramics. The customers' design engineers posed the problem; Centralab's ceramic engineers—with their wealth of experience—did the rest. Complete ceramic assemblies—ready for installation in your equipment—with tolerances to ±.00025" can readily be produced in their entirety in Centralab's modern facilities.

For additional information write for Centralab catalog 42-221 or consult Sweet's Product Design File (Folio 4a/ce).

1. **Extrusion Die:** For metal extrusion. 95% alumina outlasts alloy dies 5 to 1. Tolerances to .0005".

2. **Pump Idler Gear:** 95% alumina machined to ± .0005". Gears up to 3" diam. available. For pumping corrosive liquids.

3. **Jet Fuel Pump Piston and Sleeve:** Steatite machined with clearance of .0005" between sleeve and piston over entire length.

4. **Valve Spigot** 95% alumina polished to 3—5 helium light bands, outlasts nickel-chrome alloy 5 to 1.

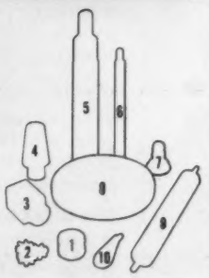
5-6. **Pump Plungers:** Surface finish of 16 micro inches. Available up to 18" long, 4" diam., not including metal attachments.

7. **Valve Seat:** Outwears hard rubber 10 to 1. Machined before firing in one operation.

8. **Antenna Insulator:** Highly glazed steatite for high voltage use. Metal attachment has bond strength of 8000 psi.

9. **Condenser Shaft:** Concentricity is ±.001 T.I.R. over entire length. Provides dimensional stability over a wide temperature range.

10. **Contact Rotor Assembly:** 85% alumina arm with precision rotor. Used to eliminate flashover and electrical breakdown.



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WHAT MATERIAL?

(An Epilogue)

E. J. Stefanides, Central States Editor

From time to time the steel industry has been unfairly blamed for almost everything from causing the recession (through automation) to being responsible for the unseasonable weather.

This reasoning has even reached the point where the success of other materials has been attributed not to their own fast-paced development but rather to a lackadaisical attitude on the part of steel—a failure to research and to develop new products and techniques. I don't think anything could be further from the truth.

This was demonstrated several weeks ago by a seminar conducted by the United States Steel Corp. during which they introduced a number of new design concepts to a group of 500 prominent design engineers. These concepts were based on the use of higher strength steels alone and in combination with structural steel.

As the seminar rolled on, it became more and more obvious that the research and development of this steel company, and others, were far ahead of the average designer, not only in providing better steels but also in developing new methods and concepts for their use.

I talked to some of the engineers after the meeting and found that many of them were impressed and were already beginning to mentally doodle some of these concepts into their own future designs. As one structural designer put it, "I can think of four or five ways in which I can use these ideas." Then came the rub, "but the building regulations won't permit it."

This same point was brought out by J. A. Gilligan of United States Steel in the paper he presented to the group. In his paper, "The Fourth Dimension in Design", he cited a design for a liquid storage vessel for the petroleum industry which used three different steels in its wall construction. In this type of vessel the pressure and resulting stress at a given elevation is dependent on the depth of fluid at that point. By using three different steels having tensile strengths of 36, 50 and 100 ksi, respectively, it is practical and possible to maintain a uniform wall thickness from the top to the bottom of the tank. This type of construction provides several advantages. Both material and shipping costs are reduced because of the decreased plate thickness and the greater strength-to-cost ratios of the higher strength steels. Welding costs are reduced because of the

decreased thickness and finally maintenance costs are reduced because of the smooth inside and outside walls.

However, this cheaper, more efficient design cannot presently be applied in this country (it has been used abroad) because of code and specification limitations prohibiting different grades of steel in the wall of a tank.

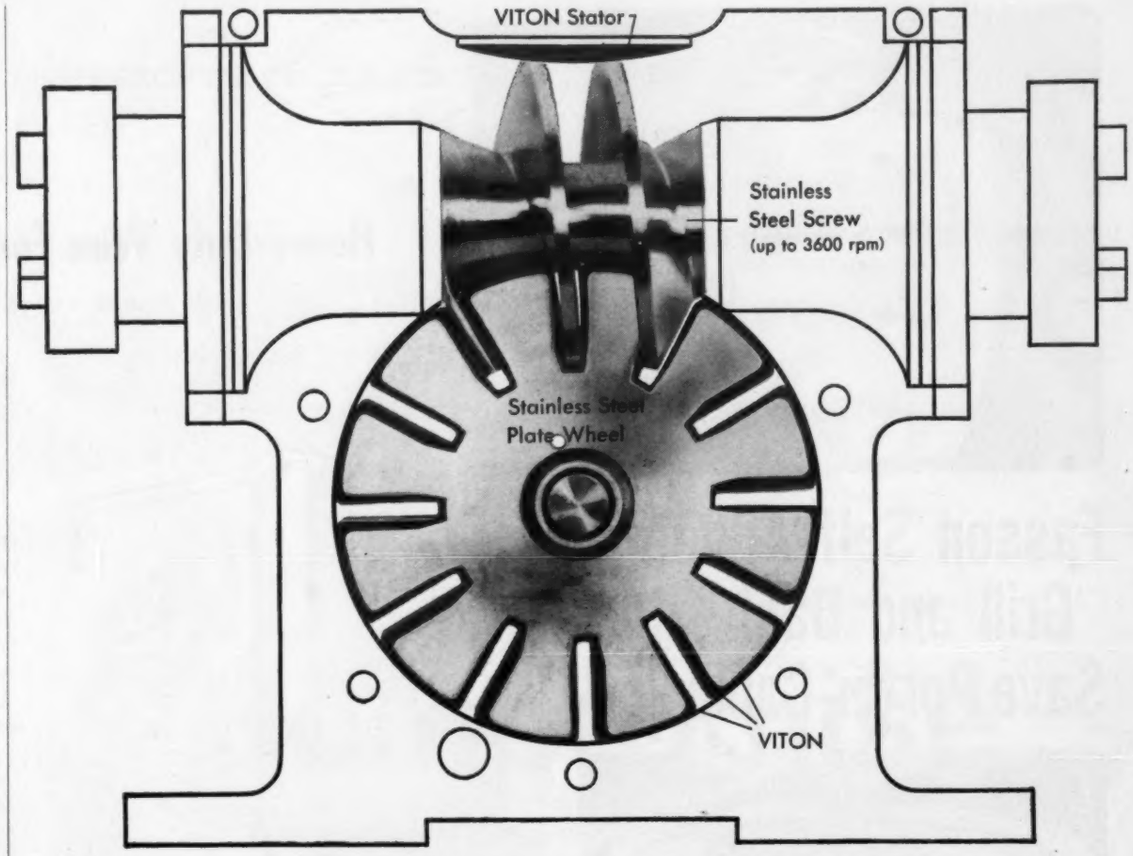
I am not disclaiming the need for regulations, codes and other design restrictions where public safety is concerned. It is the only safe and sane way to protect the public against the unscrupulous and incompetent. However, I do feel that these restrictions which constitute the design parameters should be flexible enough to incorporate new concepts when they have been proved in the laboratory and the field. Otherwise, the creative designer is shackled to an artificial design parameter and must lag in the progress being made in the production of better material and the new concepts for their use.

Several other engineers were impressed, but one said, "Well, this is all very interesting but deflection is my problem and when you reduce the cross-section, you increase the deflection and I just can't see where these higher strength steels and hybrid concepts will fit into my design."

This was particularly interesting to me because I had already seen another engineer tackle this same problem.

W. R. Hummel, Chief Engineer of Trailmobile, Inc., had this same problem in redesigning a flat bed trailer. His solution (DESIGN NEWS, Oct. 10, 1960, page 98), a good hard look at the overall design and a redesign of the flooring arrangement, allowed him to increase the depth of its beam (web only). The result: a better trailer with reduced fabrication costs and increased load-carrying capacity.

Progress in steel design comes only when the designer accepts the challenge of how to use the many available steels most economically and efficiently and when he is not limited in his thinking to the standard carbon steels. Until he realizes that the low-strength, lowest cost-per-pound steel may not be the best bargain, we will continue to see mundane, inefficient steel design and the steel industry will continue to unjustly shoulder the blame.



Durable VITON® helps solve corrosion, heat problems in design of new pulseless pump

A new twist on the 2000-year-old Archimedean screw principle has resulted in this unique positive-displacement pump, designed to handle highly viscous liquids and slurries containing abrasive and crystalline particles, without damage to crystals.

The key to the efficiency of this Goodyear* pump is the VITON-bonded plate wheel (see diagram). The slots are edged with durable VITON, which not only prevents galling, but exerts a squeegee wiping action that keeps "problem" liquids moving at full flow, without foaming or agitation.

Du Pont VITON was chosen for this application because of its exceptional resistance to corrosive chemicals and oil at high temperatures. No ordinary elastomer—natural or synthetic—could stand up to the corrosive attack while maintaining a positive seal at rotor speeds up to 3600 rpm.

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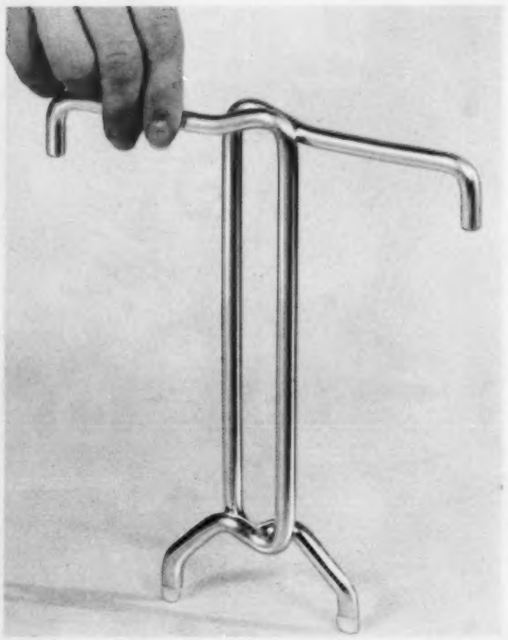
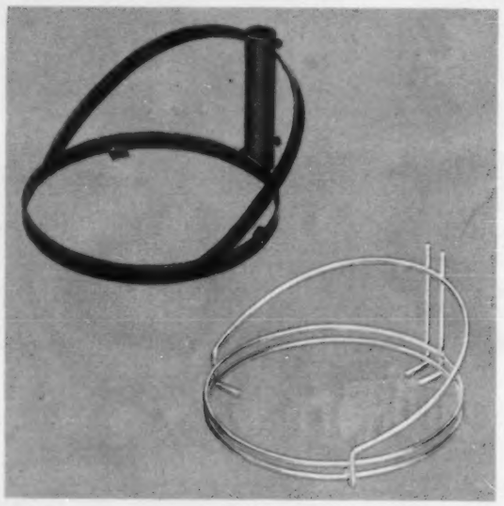
DESIGN NEWS SPECIAL REPORT

Heavy-Duty Wire Forms as Cost Savers

Victor W. Wigotsky, Eastern Editor



HEAVY-DUTY WRENCH of 5/16-inch wire, used to free jams in garbage disposer unit, replaced cast wrench that broke when hammered.

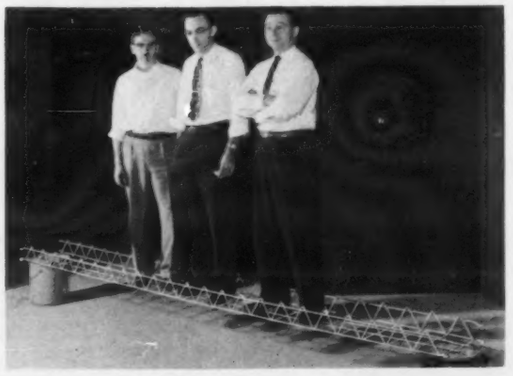


Heavy-duty welded wire forms and assemblies, with high-strength and rigidity characteristics, may have many design applications. The rugged wire construction often can replace cast, stamped and welded sheet-metal assemblies with cost savings and improved efficiency.

Low-cost wire forms are made on automatic four-slide forming machines. The wire is pulled through a series of straightening rollers, cut to proper length and formed around a center die by the motions of four sliding arms fitted with tempered dies. A great variety of different wire forms can be produced by varying the shapes of the central and sliding dies. Coiled wire up to and including 5/16 inch can be handled on these machines.

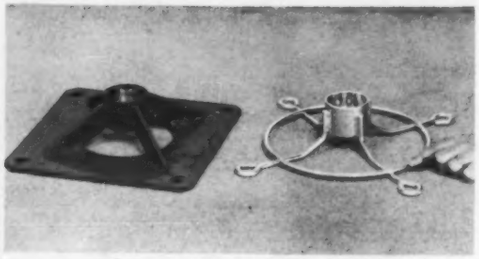
Semiautomatic equipment, power presses and special forming machines provide great versatility and make possible the use of wire up to ⅜ inch in dia. Combining wire and metal strip offers even greater freedom of design. The accompanying illustrations show some typical heavy-duty wire assemblies.

Data courtesy:
E. H. Titchener & Co., Binghamton, N. Y.

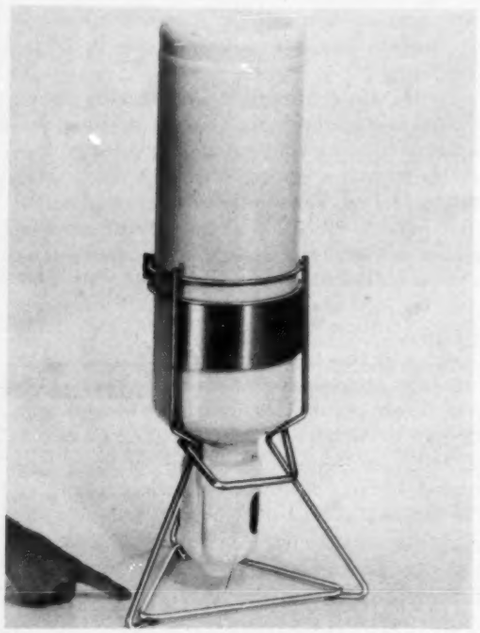


WELDED WIRE CABLE DECK, 20 ft long, readily supports weight of three men. Constructed of 5/16-inch-dia wire, open construction helps to dissipate heat.

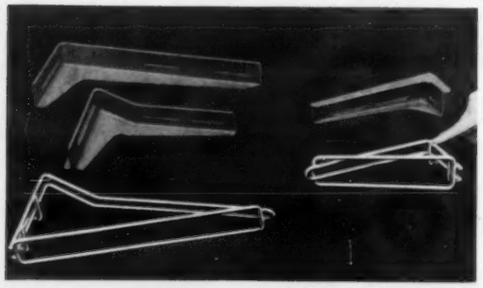
MILKING MACHINE CAN HOLDER was formerly made of welded steel strip. Wire redesign reduced weight and made holder easier to clean. The 5/16-inch provided ample strength.



MOUNTING BRACKET of ⅜-inch and 5/16-inch wire at right replaced heavy welded steel unit at left. Substantial savings in material and reduced weight resulted, without loss of strength.



DISPENSER STAND for cylinder of compressed gas is light in weight, yet has ample strength. The welded assembly is constructed of 5/16-inch wire and incorporates manufacturer's name plate and carrying handle.



FORMED-WIRE BRACKETS of 5/16-inch wire for adjustable industrial table replaced cast brackets. Weight was substantially reduced and breakage eliminated.

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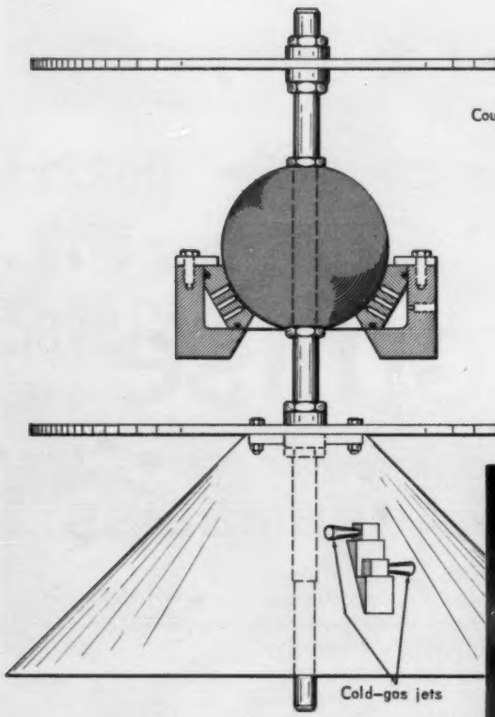
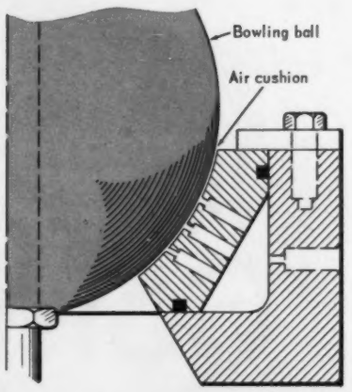
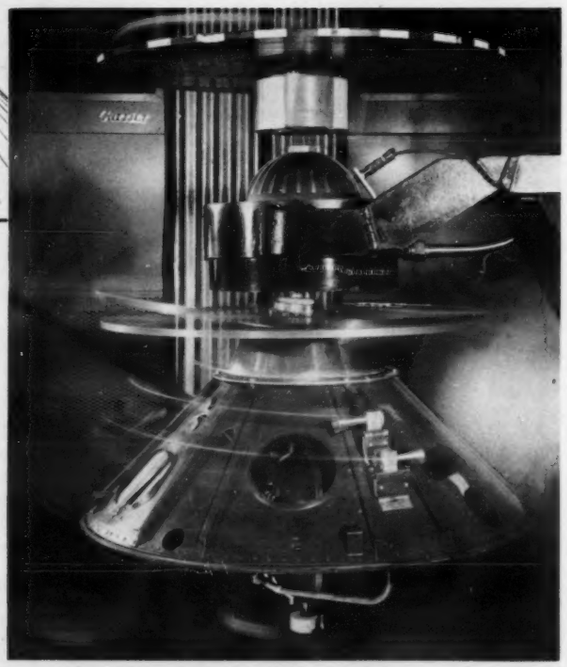
Bowling Ball Serves as Air Bearing Journal in Discoverer Spin Tests

Edward W. Schrader, Western Editor







BOWLING BALL rests on air cushion in static test bed. Test cone rigidly suspends from bottom of ball bearing. Counterweight is fixed at top of vertical shaft. Photographic unit was able to record action of forces imparted to capsule in nearly friction-free static test bed. Vernier cold-gas jets impart spin to test cone.

Difficulties in recovering the re-entry body of the Discoverer satellite in the early flights were caused by the unpredictability of the trajectory upon re-entry. This was found to be caused by the spin system employed.

To correct this deficiency, it was necessary to design, build and qualify a replacement spin and despin system utilizing cold gas and actuated by explosive cartridges or squibs. The work was accomplished in 33 days. The new system was installed on the Discoverer satellite and all subsequent capsules have been recovered in a satisfactory manner.

In order to test the system, a series of static and dynamic tests was necessary. The dynamic test structure permitted free motion in pitch and yaw, up to 17 deg with almost zero friction.

A mockup of the re-entry body was supported on a spherical air bearing, the journal of which was a bowling ball. The bowling ball was purchased from stock, and it was found to be almost perfectly balanced and within 0.001 inch of a perfect sphere.

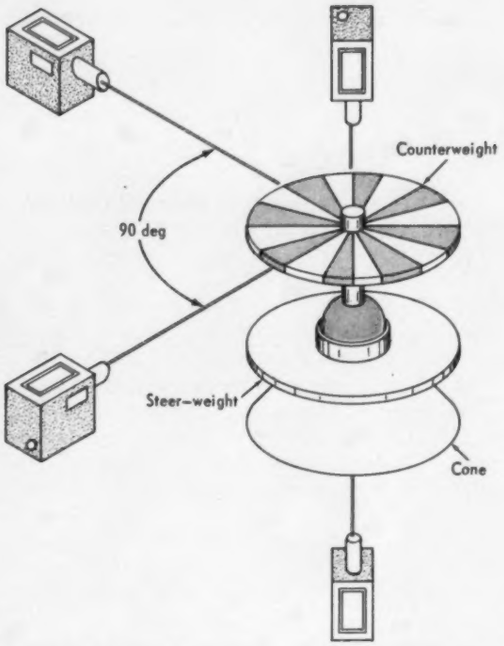
The ball was worked into the race with an ordinary abrasive compound. Compressed air entering through a series of small holes in the face of the bearing race creates a low-pressure air cushion between the ball and the race.

To maintain tolerances in the air bearing, the tests were conducted in a temperature-controlled room. The critical temperature control necessitated an absolute minimum in radiant heating from light sources for the photographic technique employed to take measurements. A Color-Tran lighting system allowed all lights to burn at a very low voltage until cameras reached speed and triggered the system to high-intensity light.

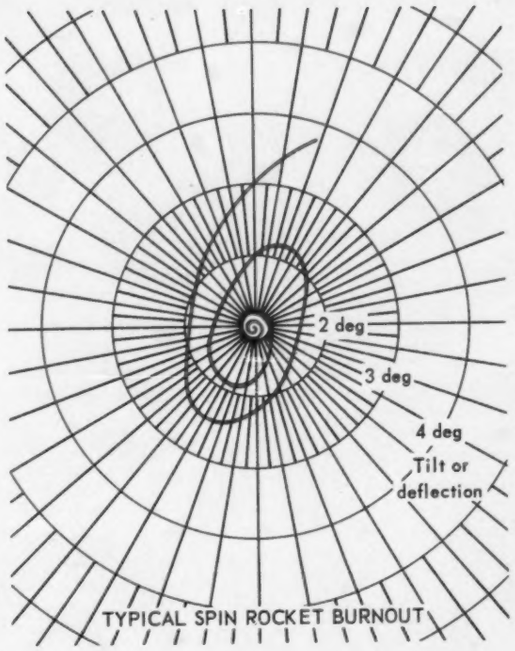
The air-bearing tests were conducted at frequency of one every 5 hours. Black and white film, with hand processing, was used to expedite data reduction between tests.

A total of 68 valves were functioned; 21 static tests and 14 dynamic tests were conducted with the complete gas system. No failures occurred in any of these tests.

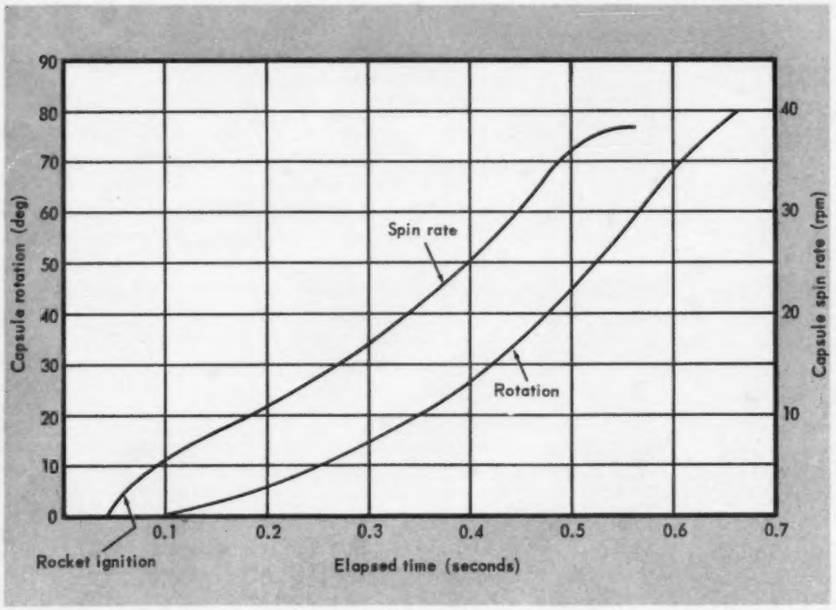
Members of the Ordnance Research Dept. at Lockheed's Santa Cruz Test Base designed the unique method used in the dynamic test fixture.



CAMERAS RECORD ACTION of re-entry body. Camera at top records rotation of counter balance, which is painted with alternating red and white stripes. Two cameras at side are placed at 90-deg angle and equidistant from test vehicle. Directly beneath is fourth camera focused upward to observe vehicle deviations on its vertical axis. All cameras operate at 200 fps (exposure time, 1 millisecond) and record 1000 and 60 pulse-per-second timing. Time correction between cameras was accomplished by interrupting 1000 pps after cameras were running. As backup time reference, flash bulb is fired by same electric impulse that starts actual test. Bulb is in field of all cameras.



ILLUSTRATIVE POLAR PLOT (not actual data) gives graphic picture of deflection, rotation and time intervals. Actual test film was projected to polar plot and center point of counterweight plotted for each frame. To provide reference for actual test results, test vehicle was tilted physically at 1-deg intervals and 1-frame exposures were made. This series of plots served as calibration for tests.



ILLUSTRATIVE GRAPH (not actual data) shows spin rate versus elapsed time, and rotation of capsule with time. Time differential between rocket ignitions is 0.005 sec.

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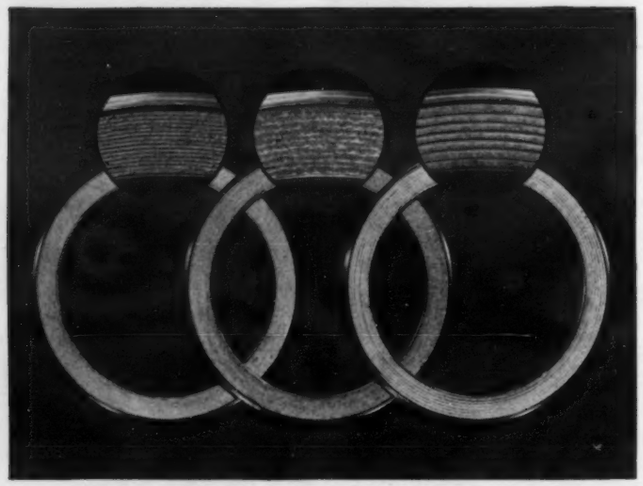

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Complete range of sizes, shapes and wide temperature range are more reasons for specifying Garlock GUARDIAN Gaskets . . . 1/16" thickness up to 6", 1/8" up to 30", .175" up to 60" and 1/4" thick up to 60" depending on flange width. For temperatures up to +1900°F. with ceramic filler material.

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Bead-Chain Rotates Synchro In Antenna-Positioning Indicator

Edward W. Schrader, Western Editor

A bead-chain drives the synchro and assures accurate indication of linear extension of an antenna. As the antenna extends, the bead-chain rolls over a sprocket in which is sealed a synchro transmitter. The chain is stored by winding it around a storage drum at the bottom of the unit.

A constant-torque spring has one spool connected to the storage drum. The spring insures uniform, constant torque, regardless of how far the chain is extended. The bead-chain is prerun under tension to permanently set the pitch before the chain is mounted in the indicator.

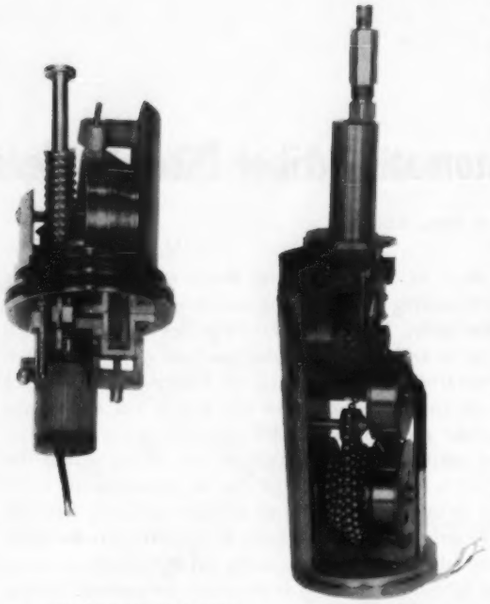
This design replaces a previous design to effect a savings of approximately two-thirds of unit cost. The original design used a large spool, on which was wound a 40-lb test stainless-steel fish line. The fish line extended as the hydraulic piston traveled vertically. The spool, through a set of 11 gears, turned a synchro at the bottom of the unit. Inside the spool a clock spring kept the line tight and returned the line to the spool as the antenna retracted.

Several large O-ring seals separated the oil-flooded portion of the mechanism from the synchro. In the new design, the synchro operates inside the indicator sprocket, sealed off from the oil. One large O-ring seal in the new design is used at the very bottom, and the entire unit may be immersed in oil.

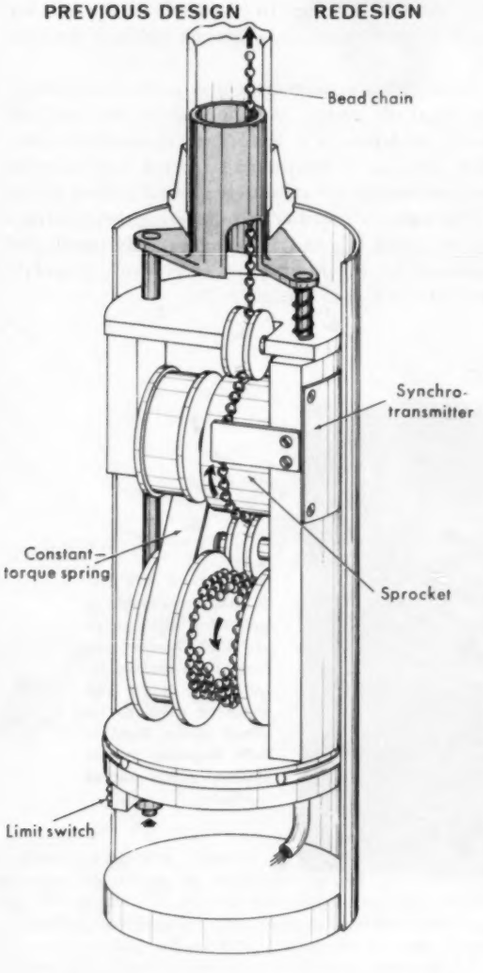
The leader in the original design was connected to the piston by means of a swivel socket. Should this swivel bind in use, the string would twist and possibly break. The bead-chain, however, can swivel at each ball and will not bind.

The "Ball-Chain Position Transmitter" is a design of Military Products Div., Hoffman Electronics Corp., Los Angeles, Calif.

BEAD-CHAIN unwinds from drum as hydraulic operated piston in position transmitter extends. Guide roller insures chain contact with sprocket. Sprocket is made of nylon impregnated with molybdenum disulphide.



PREVIOUS DESIGN REDESIGN



Some Ideas

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Template layouts never had it so tough!

Here's one for the many industries which cut or shape big pieces of metal, like shipbuilding, machinery manufacturing, steel milling, etc. In these areas it is fast becoming standard procedure to use template layouts with a pantograph follower or other sensing apparatus to guide the torch that cuts the metal itself. This practice calls for a tough, sharp, stable layout, and – although costly to work on and hard to handle – steel and aluminum are widely used for the purpose. A far *better* answer is now available in Opaque Pencil & Ink STABILENE (W138H-2). Coated on both sides with a white, matte, engineered drafting surface, this STABILENE Film takes and holds a sharp pencil or ink line exceptionally well – both readily erasable. Its extreme whiteness assures the vivid contrast required. Completely washable (when waterproof pencil or ink is used), it can shrug off the worst metal-shop soil. Unlike metal, it is flexible, crease-resistant, and rolls up for easy storage. Best of all, STABILENE affords thermal stability better than steel or aluminum . . . and its tough, tear-proof base takes the roughest handling in stride.

All that's seen through isn't glass!

In this case, it's another popular STABILENE medium – a glass-clear overlay film, specially prepared to accept ink and artists colors as used in all types of overlays. In comparison, the acetate commonly used for these applications is virtually obsolete. STABILENE Overlay Film (129T) is easier to work on, and takes and holds ink or color better.

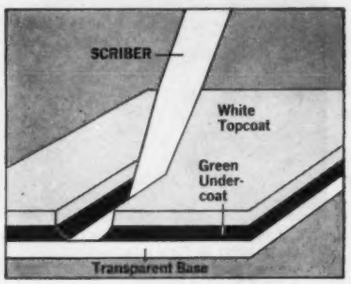
No special acetate inks are needed, either. Regular Pelikan black or colored ink works perfectly. Also, while acetate tears easily and "creeps" perceptibly under varying temperature conditions, STABILENE affords vastly *superior* strength and stability.

Another popular use for STABILENE Overlay Film is in the preparation of slides for overhead projectors. With glass-clear STABILENE, slides can be made in 2 minutes flat directly from any opaque original using a standard photo-transfer copier of the Verifax type. For these applications, STABILENE Overlay Film is available in sizes to fit 7" x 7" and 10" x 10" projectors.

Throw away your light tables!

As more and more draftsmen are discovering, the surest way to sharp, clean, accurate layouts is to set aside pen and pencil and *scribe*. With this modern technique, there's never any smudging or variation in line width, density or sharpness. Scribing also eliminates the inaccuracies and mess caused by clogged, dull or ill-adjusted pens. One medium that offers an important *plus* is STABILENE White on Green Scribe-Coat (WG132H). Combining permanent flexibility, toughness and extreme dimensional stability, STABILENE Scribe-Coat is truly an ideal scribing medium. And the important *plus*, its unique visual property, *eliminates the need for a light table*. As shown below, a line scribed into this film cuts through both a white topcoating and a green undercoating to a transparent base beneath. Thus, the cut edge of the green undercoating becomes readily visible, making scribed lines as easy to see as the hand that scribed them.

These of course, are but a few of many STABILENE media and applications. In mapping, printed circuitry, lithography and many other areas, STABILENE is fast becoming indispensable. A sample of each STABILENE Film discussed here is yours for the asking. Free literature describes many other applications. For both simply mail the coupon below.



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Automatic Scriber Dices Wafers

E. J. Stefanides, Central States Editor

A glass-cutting action is used in a new automatic transistor wafer scriber to dice silicon and germanium semiconductor material. This method of operation combines high production output with minimum waste and uniformity of size. In addition, it allows automatic production with a simple design that can be adapted readily to a variety of sizes.

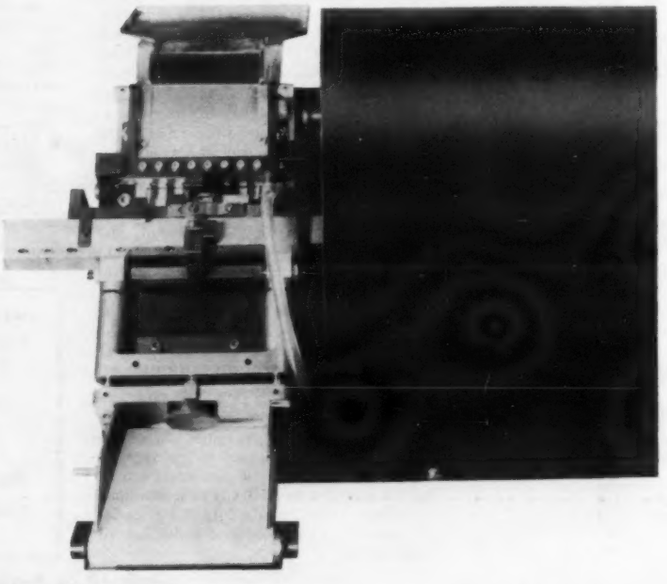
The scribing is performed by a diamond scriber mounted on a slide. The slide is actuated by an electric-motor-driven crank mechanism which drives the scriber back and forth across the material to be cut. Immediately following the completion of the scribing stroke, the breaker is depressed automatically by a cam-block arrangement. This breaks the material over the edge of an accurately ground cutting bar, separating it along the scribed line.

One of the problems involved in automatic dicing of these wafers is providing a means for automatically feeding and accurately gaging the material to be cut. This problem is complicated by the additional requirement that the machine be adaptable to cutting a variety of sizes of strips from wafers and blanks from strips.

In designing this machine it was decided that these problems could best be overcome by a simple system of cam blocks and levers which synchronize the feeding and breaking action with the motion of the slide. The wafer or strip lies on an inclined platen and is fed into the machine by gravity. It is restrained during cutting by fingers actuated by a cam surface attached to the slider. On the return stroke the cam lifts the fingers, releasing the wafer or strip. Simultaneously with the lifting of the fingers, a lobe on the crank disc depresses an air valve to deliver air to a series of ports directly beneath the strip or wafer. Air from these ports lifts the leading edge of the strip or wafer off the platen and acts as bearings to allow it to move downward. Downward motion is halted by the front of the breaker plate; this automatically gages the width of the next cut.

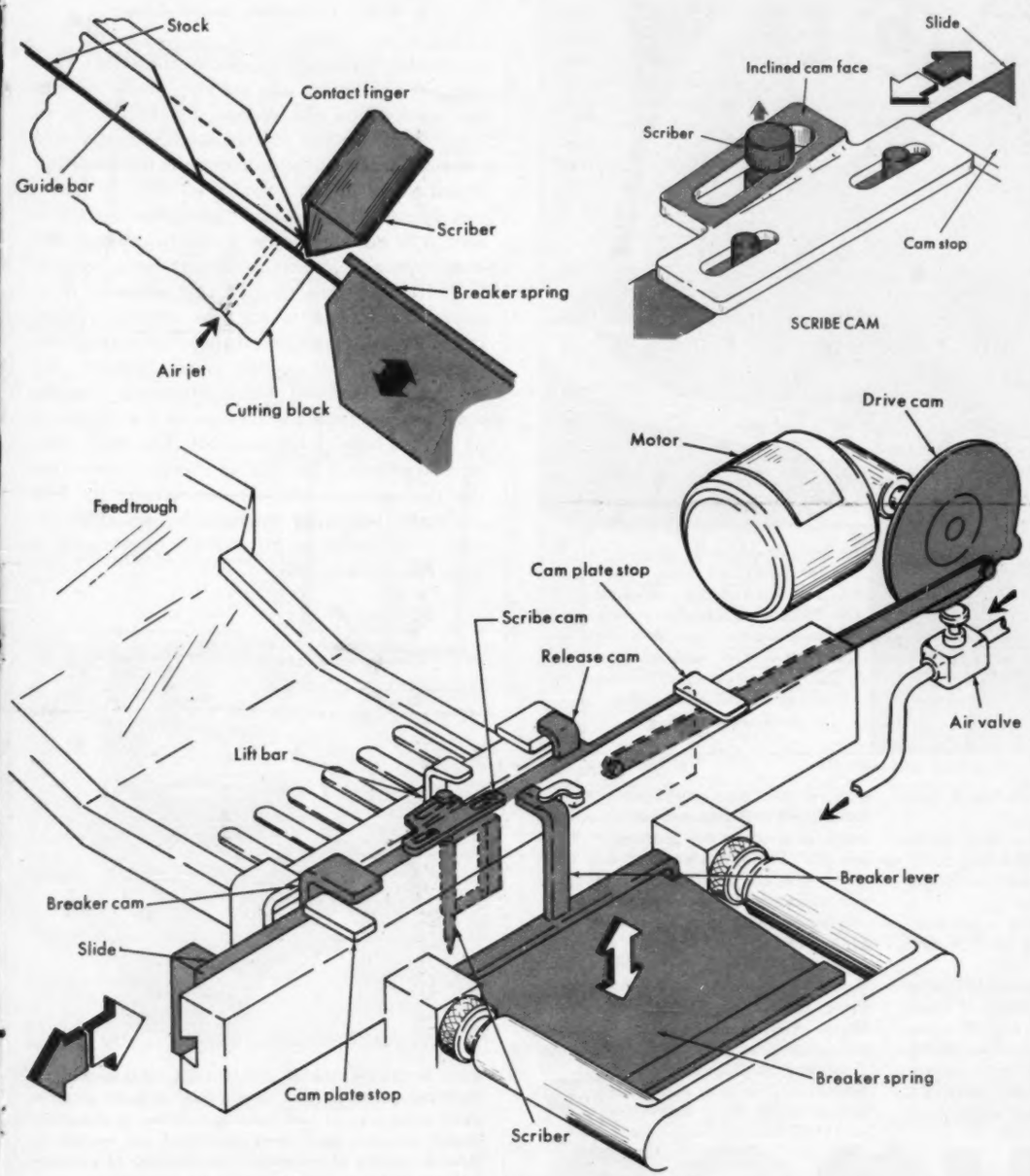
A cam lever arrangement also is used to provide the break-off action. At the end of the scribing stroke, it depresses a leaf-spring mounted breaker plate, forcing it downward to break the material over the edge of the accurately ground cutting block.

The automatic scriber incorporating these features was designed by, and is being manufactured and marketed by, the Equipment Operations, Lansdale Div., Philco Corp., Lansdale, Pa.

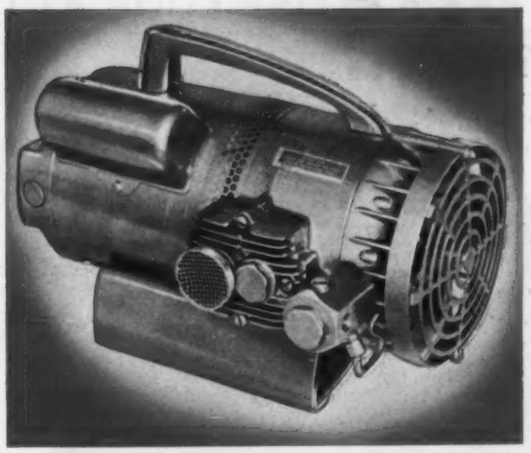


AUTOMATIC SCRIBER is capable of producing 1200 strips or 8000 blanks per hour. Only manual requirement is to feed wafer or strips to inclined platen. Rubber-belt conveyor carries finished pieces out of machine.

with Glass-Cutting Action



SCRIBING POINT is automatically lowered for cutting and raised during return by stops and inclined slot in scribe cam. At end of scribing stroke (to right), scriber point is lifted and break-off plate is depressed by cam surface separating cut portion along scribed line. During return stroke, cam surfaces lift fingers, releasing material and allowing it to move downward against breaker plate and gaging width of next cut. To convert from blank to strip cutting, short, center finger bars are removed. Adjustment screw at bottom of frame provides adjustment for width of cut-off piece. Speed adjustment and cutting pressure are adjustable to suit hardness and surface conditions of material being handled.



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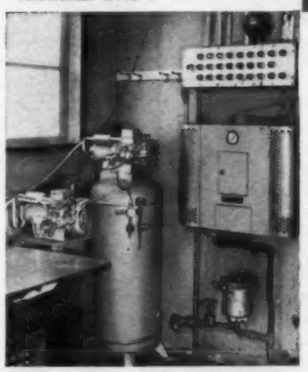

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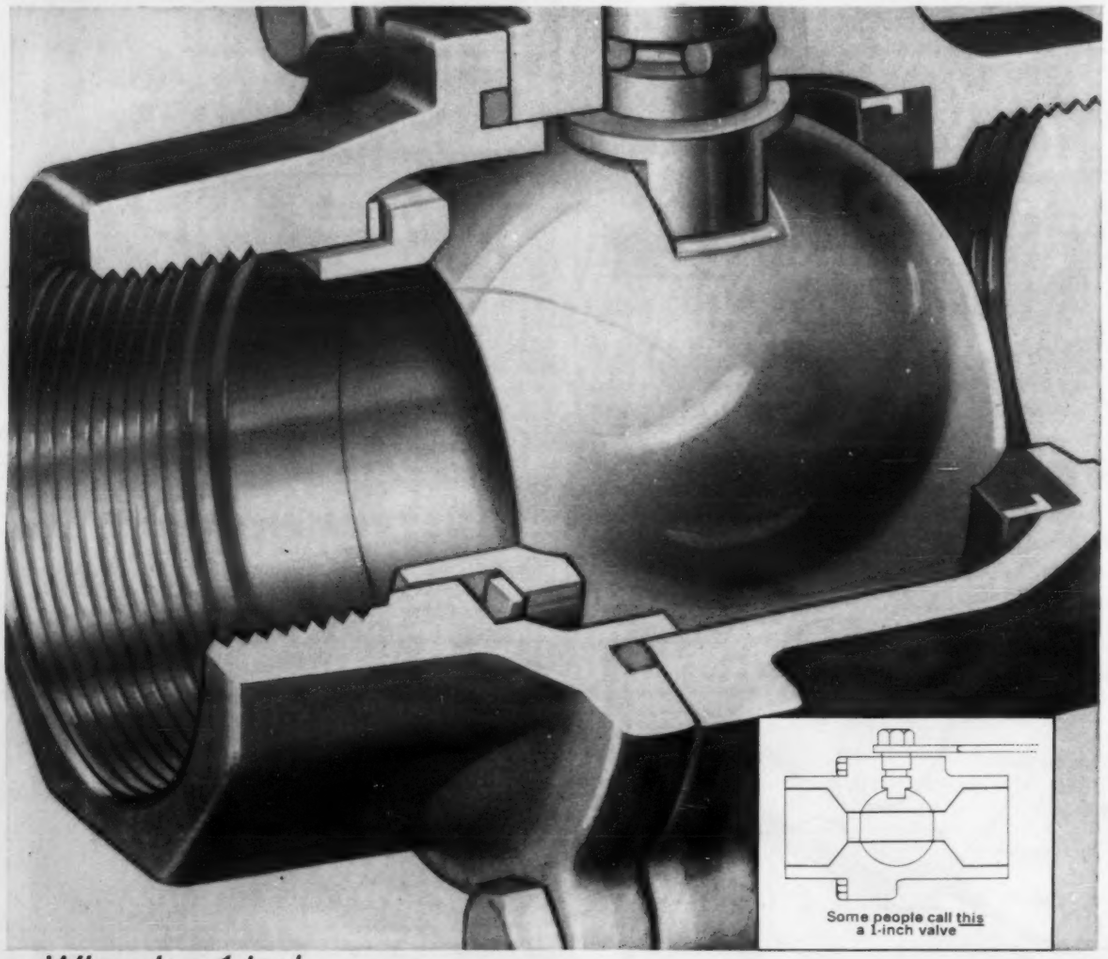
TAKE A CLOSE LOOK AT ROCKWOOD BALL VALVES



When is a 1-inch valve NOT a 1-inch valve?

When the waterway diameter of a ball valve is smaller than the pipe size you can't get perfectly smooth flow. If this difference is large, flow is more turbulent and pressure loss much greater. So it pays to compare waterway sizes before you buy any ball valve. You'll find that Rockwood ball valves have the largest waterway diameters — per given valve size. This means smoother, more economical operation in your line — whether you move liquid, gas or solids.

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Ruggedness — durably built for longer service under severe use.

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ROCKWOOD

BALL VALVES

Circle 15 on Reader-Service Card for more information

Cone-and-Cup Electric

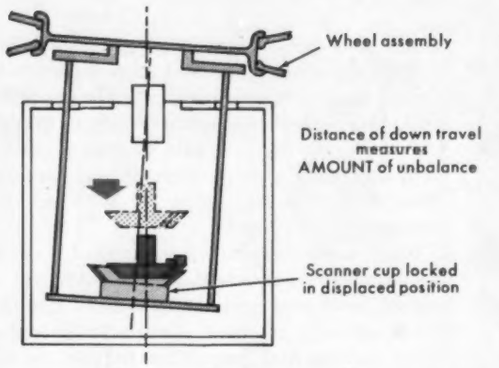
Robert L. Candlish, Detroit Editor

A circular cone-and-cup electrical contact controls the mechanism of a marking device to indicate the location and amount of unbalance in an automobile tire and wheel assembly. A tilt-table static-balancing machine determines the condition of unbalance in the assembly.

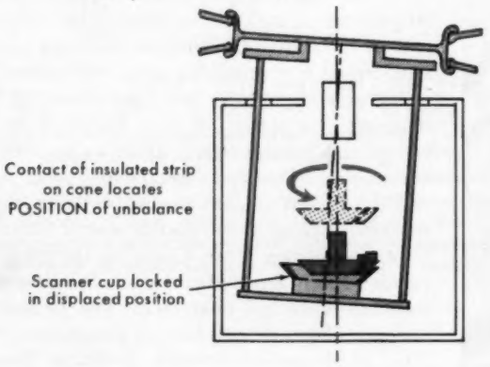
A highly legible colored molten-wax mark is used. The marking system is electrically operated directly by simple mechanical switchgear controlling electric brakes, clutches and solenoids. Two marks are applied to the tire. One individual mark shows the location of the unbalance. A second group of color-coded marks indicates the amount of unbalance. The combination of marks determines the size and location of the weight to be used to balance the assembly. The marks also serve as reference for quality check to determine that the proper weight was located correctly. The automatic balancing machine for wheel assemblies is produced by Micro-Poise Engineering & Sales Co., Detroit, Mich.

TWO MARKING-HEAD ASSEMBLIES are mounted over wheel assembly. One head on arm rotating about center of wheel drops wax on tire, marking location of unbalance. Second stationary head ejects color-coded wax on tire, indicating amount of unbalance. Combination of markings permits worker to locate proper weights to balance assembly. Lineshaft motor-driven by pulley on lower end drives scanner cone through electric clutch and brake system. Lower electric system lowers cone by lead screw and also drives rotary cam switch, selecting proper solenoid in color-coded wax ejection system. Upper electric system rotates both scanner cone and rotary marking arm.

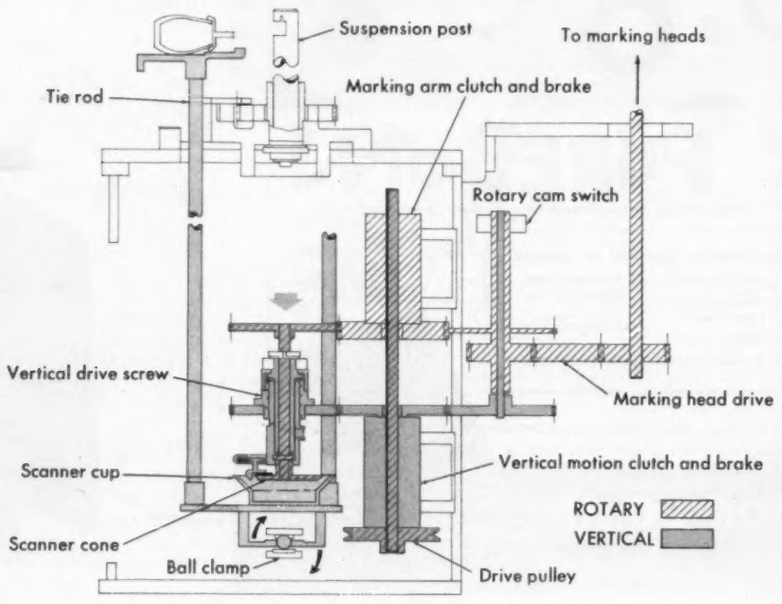
Contact Controls Wheel Balance Marker



TILT - TABLE STATIC - BALANCING MACHINE represented in schematic is basis of machine. Suspension system for table provides flexible universal mounting. Center spindle on balancer locates wheel assembly concentrically over table suspension support. Unbalanced part mounted on table causes table to tilt down on heavy side in proportion to unbalance.



AMOUNT OF UNBALANCE is first determination. Load table assembly is permitted to establish stable tilted position due to unbalance in test part. Table then is locked in this position by ball clamp. Amount of unbalance determines deflection of cup and distance scanner cone must travel to make contact. Motor drive causes scanner cone to rotate and at same time drop down toward cup. Contact of cup and cone trips advance-drive electric clutch and locks electric brake, holding cup in contact with cone. Rotary cam switch at same time controls color of wax to be ejected on tire. Binary system of marking permits simple selection of weights in range from ½ to 7½ oz in ½-oz increments. Unbalance location is determined after amount of unbalance has been established. Scanner cone continues to rotate in contact with cup until insulating segment on cone contacts cup, interrupting current, tripping rotary-drive electric clutch. Electric brake on scanner drive and on rotary marking arm are locked simultaneously, locating marking arm over point of unbalance.



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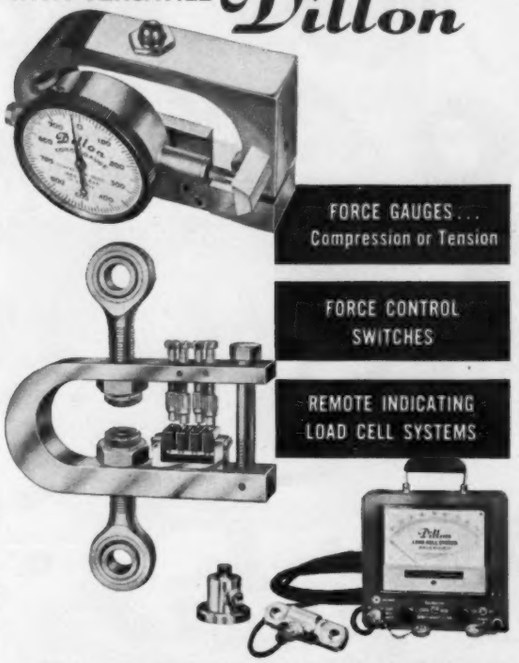

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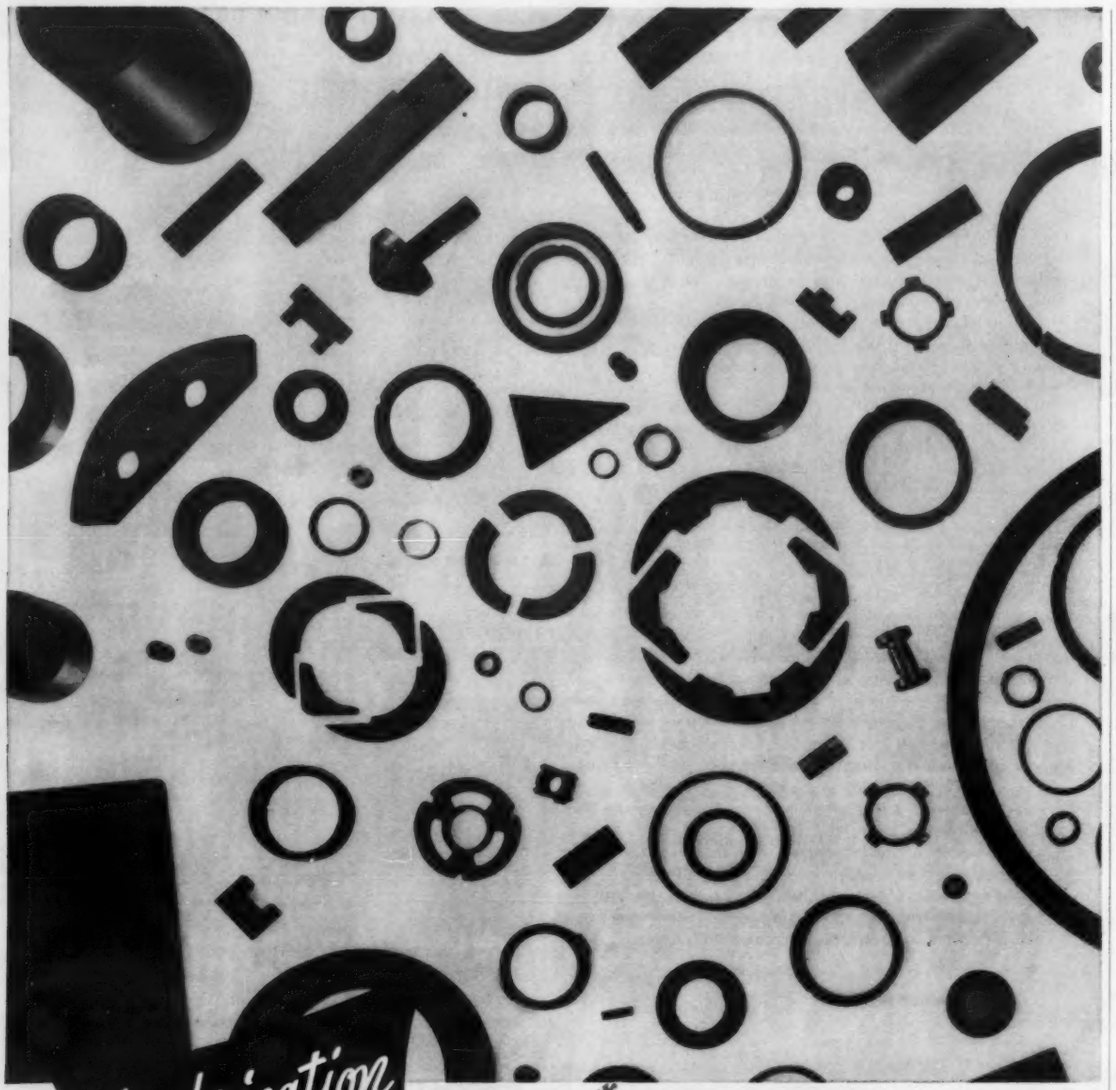
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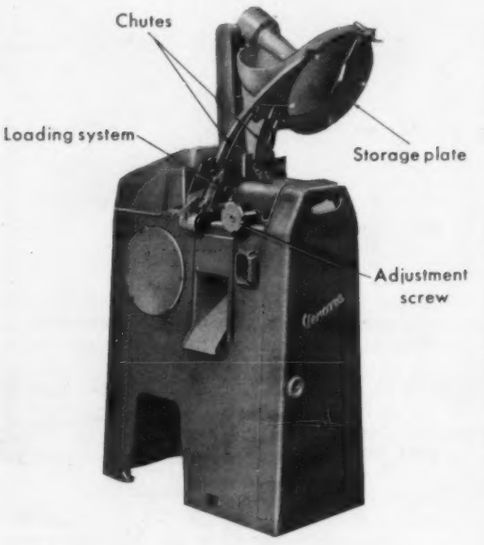
Easily Changed Cams

Celestino O. Lubatti, Italian Editor

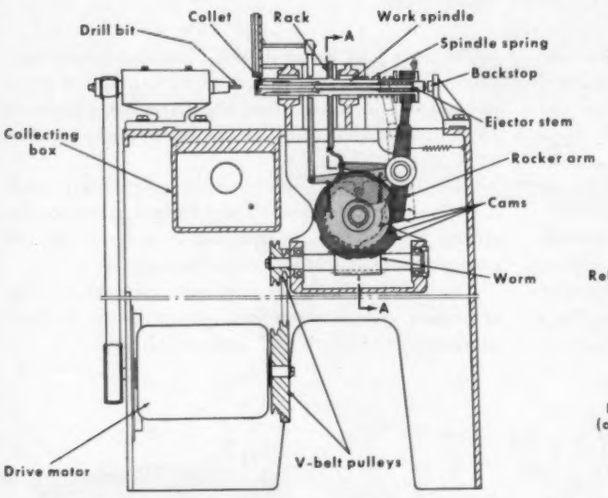
Replaceable feed cams in a drill press vary speed of work advancement without proportionately retarding nonproductive operations. The machine is used in high-speed production-drilling of buttons. Choice of indexing cams with varying number of steps facilitates work-program change for automatic drilling of any number of holes per cycle (normally two to four).

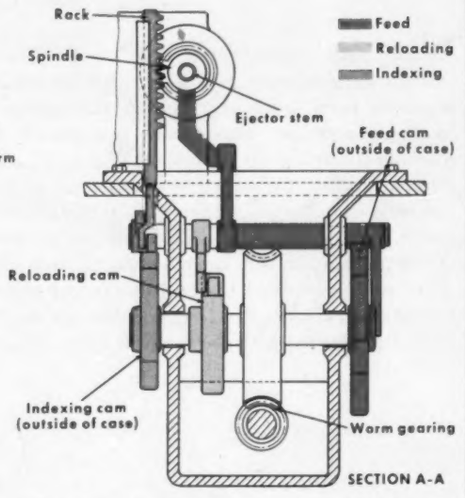
When mother-of-pearl or other hard materials are machined, proper feed-cam outline halves the normal work-feed without necessarily doubling the length of a complete work cycle. Driveshaft speed and machine output are reduced by only 30 percent. A rocker arm sensing the feed-cam outline intermittently advances the work spindle and retracts it against a backstop which opens the collet for workpiece discharge and reloading. The indexing cam shifts the work angularly at the end of each partial return stroke to produce the desired number of holes per cycle.

The collet is refilled automatically by a conventional cam-operated loading system including a rotating storage plate. Changing the reloading cam is not required because of small influence of refill operation on total cycle. The production drill is a design development of Costruzioni Meccanniche Francesco Bonetti, Rudiano, Brescia, Italy.

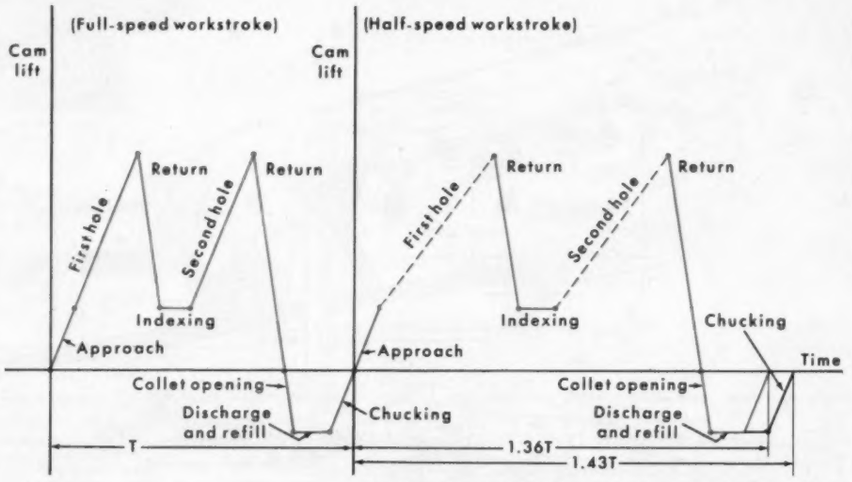


Add Versatility to High-Speed Drill Press





FEED CAM swings spring-loaded rocker arm, moving work spindle against drill. At end of first drilling stroke, feed-cam recess allows partial expansion of spindle spring and retraction of workpiece. Indexing cam lifts rack to swing spindle by predetermined angle (normally 90, 120 or 180 deg). Successive projections and recesses on feed cam cause reciprocating movement of spindle for next holes. Deep recess causes return of spindle as fourth hole is drilled. Backstop limits retraction of ejector stem; full spindle spring-back allows expansion of collet and ejection of finished workpiece into collecting box. Reloading cam operates leverage for automatic frontal refill of collet. V-belt drive allows choice of speed ratio. Indexing and feed cams are placed outside gear case to facilitate replacement.



DUAL-SPINDLE PRODUCTION DRILL uses needle-shaped bits rotated at 15,000 rpm by single 1-hp motor. Adjustment screw offsets drill bits to vary distance of holes from spindle center. Cam-driven pincers transfer pieces from storage-plate chutes to collets. Maximum machine output is 48 gross (6900 buttons) per hour.

HALF-SPEED of work advancement is conventionally obtained by cutting driveshaft speed to one-half. This doubles length of all operations and halves machine output. Replaceable cams retard only cutting strokes to maintain satisfactory output for any type of button material.

*½" horizontal side space/less than 2" vertical side space/ 75 lb. load capacity/write for additional information/

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✻ ON-THE-JOB PROOF AT **PIONEER**

Specially hardened and heat treated Helicon gears are used in the engine transmission of the Pincor Twenty One front throw trimmer power mower manufactured by the Pioneer Gen-E-Motor Corporation. Helicon gears were chosen because they provide the desired reduction, have excellent loading characteristics for their size, offer simple alignment, are noiseless and give longer service.

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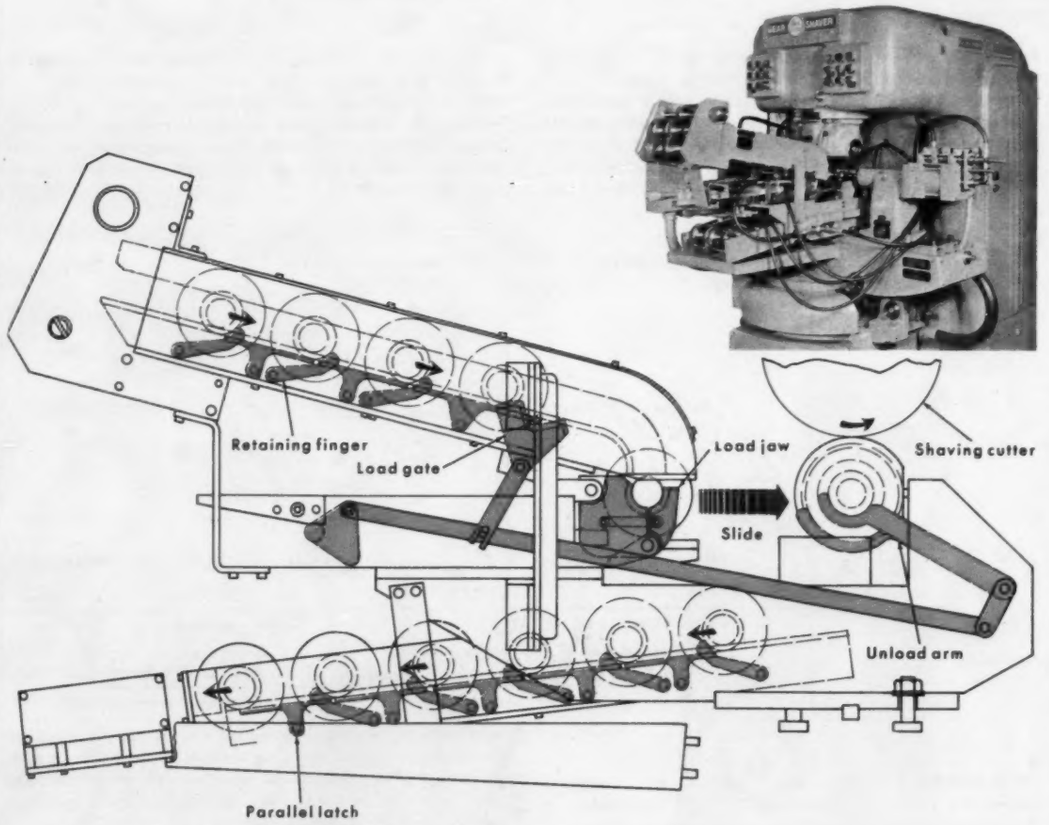
Slide-Action Loader

Robert L. Candlish, Detroit Editor

An automatic loading mechanism, designed to control the flow of gears into a gear-shaving machine, separates parts from one another throughout the loading operation. The loader is operated by a solenoid-controlled air cylinder that actuates a slide. Parts automatically are fed, one at a time, at spaced intervals into the machining position, clamped between centers, processed in a controlled machining cycle, unclamped and carried into an exit chute. They then are rolled to the front of the machine for pickup. Advancement of parts through the loader is synchronized with the machine cycle. Dumping of the next part to be shaved from the infeed rack causes the infeed racks to advance all unshaved parts one station forward; thus, the parts are protected from damage that could be caused by bumping into each other.

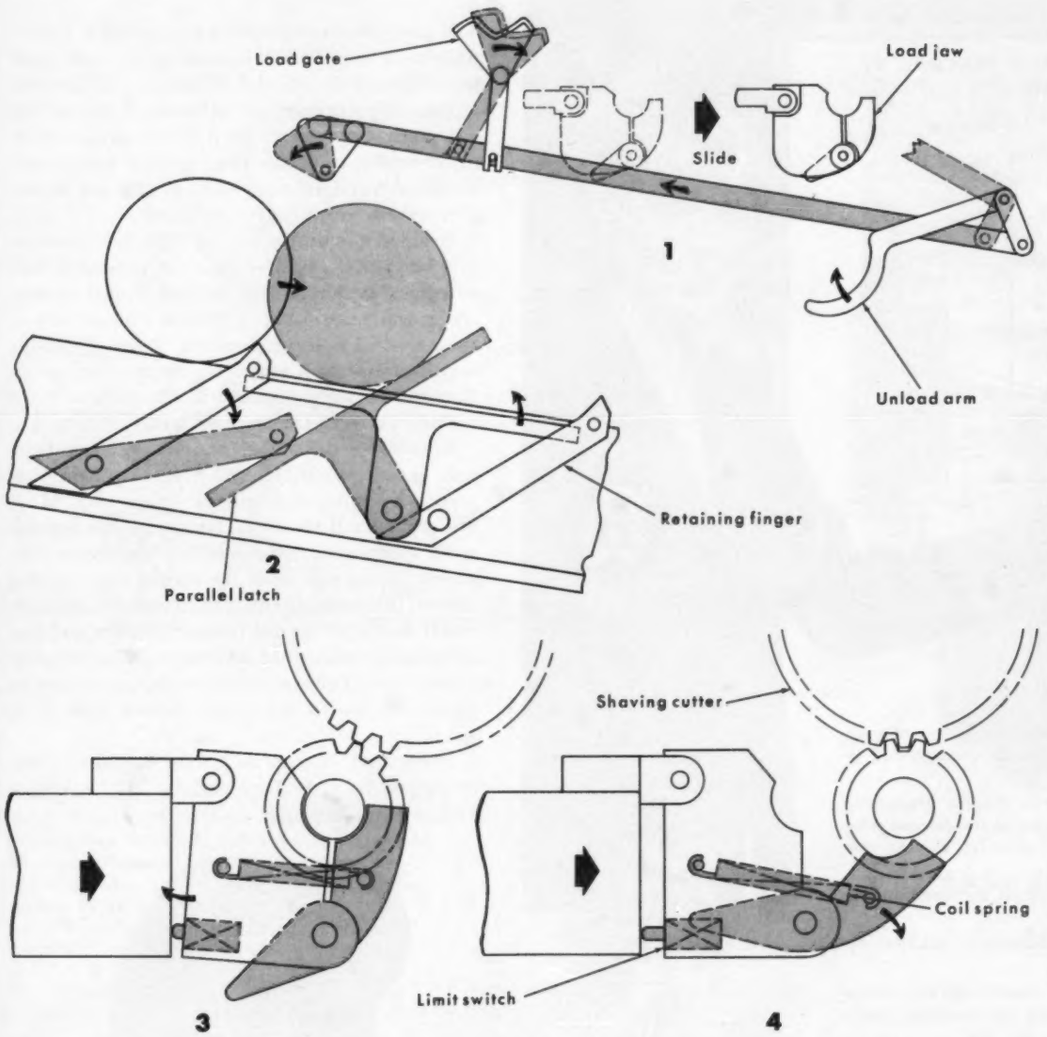
The shaver processes 14-tooth, 1.6867-inch pitch dia gears on the automotive standard transmission cluster gear. Parts are handled at the rate of 150 pieces per hr at 100 percent efficiency.

The automatic loader feed unit for gear shaving or honing machines is a development of the National Broach & Machine Co., Detroit, Mich.



AUTOMATIC LOADER is accessory for gear-shaving machine. To protect shaving cutter, no-go gear-rolling-type gage is mounted on loader entry to prevent loading of oversize parts.

Prevents Part-to-Part Damage in Gear Shaver



(1) **AUTOMATIC LOADER** is supplied from "raw part" rack and delivers to "finished part" rack. Loading jaw mounted in reciprocating slide carries work to centers. Forward motion of slide also moves reciprocating arm, admitting raw part to load gate and lowering finished part from work centers onto "finished part" rack. Retraction of slide and load jaw dumps raw part from load gate into load jaw. Unload arms raise to accept next part finished. Proximity switch in "finished part" rack interrupts cycle should rack already be full.

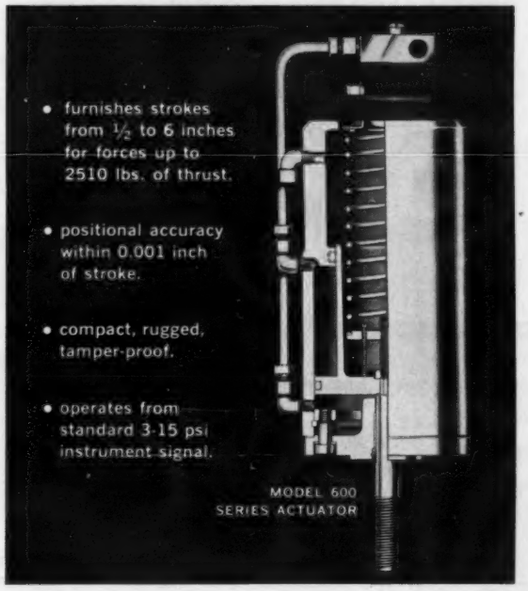
(2) **OPERATION OF STORAGE RACKS** depends on position of parts in rack. Removal of last part from rack permits parallel latch to tilt, allowing part-retaining fingers to drop. Part then rolls down rack until weight of part on parallel latch returns it and retaining fingers back into "stop" position. Parts are thereby fed down rack one by one.

(3) **TOOTH-TO-TOOTH INTERFERENCE** on loading causes load jaw to pivot downward, tripping limit switch. This signals automatic partial withdrawal of slide and second attempt at proper engagement. Tooth-to-tooth interference is unique. Jog of shaving cutter by part on failure to load assures proper engagement on next attempt.

(4) **WHEN PART IS POSITIONED** and properly meshed with shaving cutter, centers advance axially into part. Load jaw retracts and opens against force of coil spring, leaving part on centers ready to process.

STROKE POSITIONING ACTUATOR

FOR THE PRECISE CONTROL OF YOUR VARIABLE SPEED DRIVES • CONTROL VALVES • RHEOSTATS & PUMPS!


• furnishes strokes from ½ to 6 inches for forces up to 2510 lbs. of thrust.
• positional accuracy within 0.001 inch of stroke.
• compact, rugged, tamper-proof.
• operates from standard 3-15 psi instrument signal.
MODEL 600 SERIES ACTUATOR

Adaptability, speed, precise positioning and *power* are features of Annin's 600 Series actuators, designed for easy mounting on your existing equipment. Compact and rugged, these units may be operated from a standard 3-15 psi instrument signal, with a positional accuracy within 0.001 inch per inch of stroke. Supply pressures as high as 100 psig of air or gas can be used as the actuating medium. The compact, tamper-proof construction practically eliminates maintenance. Given a clean dry supply medium, long periods of trouble-free operation can be expected.

SEND FOR COMPLETE DETAILS
Ask for Actuator Bulletin 1236 s.t. containing complete technical information on Series 600 and other Annin actuators.

THE ANNIN COMPANY

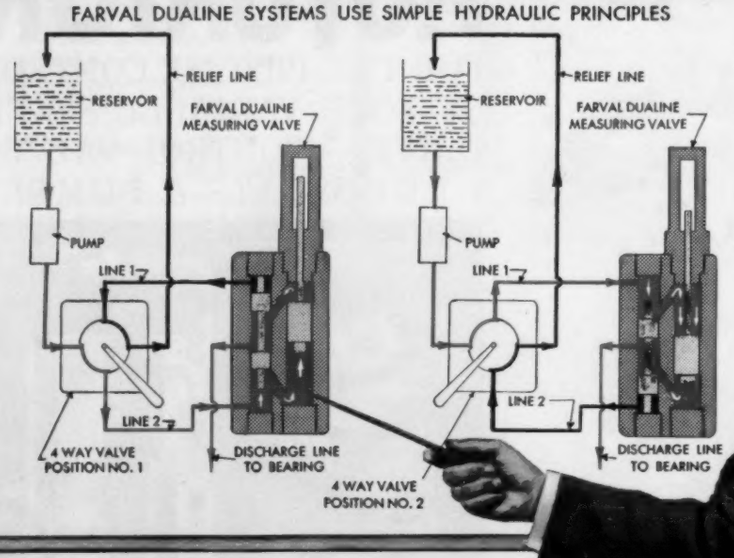
DEPT. D • 1040 South Vail Avenue • Montebello, Calif.

Circle 20 on Reader-Service Card for more information

FARVAL
—Studies in Centralized Lubrication
No. 246

"For positive lubrication of large, medium and heavy-duty installations . . . it's a Farval Dualine System!"

FARVAL DUALINE SYSTEMS USE SIMPLE HYDRAULIC PRINCIPLES



With Farval Dualine centralized lubricating systems you get the following distinct advantages over other type systems . . .

(a) Much lower operating pressures with consequently less danger of soap separation on grease systems. Also, less danger of system damage due to high lubricant pressures.

(b) Large lubricant passages with no pinhole ports, ensures practically full pump pressure for every metering valve. This is one of the reasons why Farval Dualine systems operate on lower pressures — give less sieving and working of lubricants.

(c) Positive indication at each bearing — does not have to depend on the questionable action of a single indicator at the pump.

(d) Each metering valve individually adjustable for the requirements of the bearing it serves.

(e) Independent metering valve operation. Should trouble develop with one valve, the system will continue to operate. Only one bearing (not all the bearings) will require hand lubrication until trouble is corrected.

(f) True lubricant metering. Quantity of lubricant delivered to one bearing is not dependent on any other valve in the system.

(g) Much easier to spot and correct trouble.

Check with your Farval Representative and see how these versatile systems can improve production operations — reduce costs. Or write for free Bulletin 26-T containing complete engineering information on Farval Dualine systems.

Farval Division
Eaton Manufacturing Company
3292 East 80th Street • Cleveland 4, Ohio

Circle 21 on Reader-Service Card for more information

Point-by-Point Profile

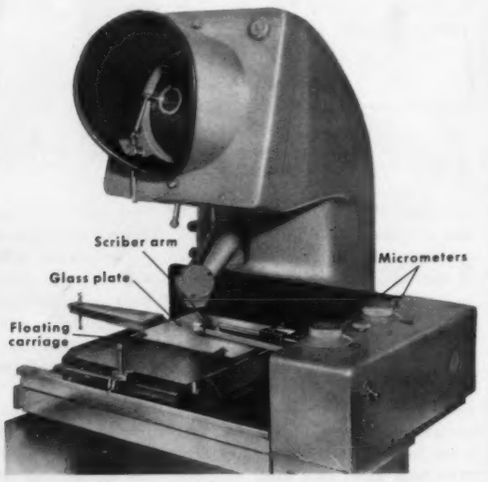
Ronald W. E. Martin, British Editor

The same mechanical system first causes a master trace to be inscribed on a coated glass plate, then permits an optical display of that trace to provide a point-by-point comparison between master and test piece. Component itself is not projected as in conventional profile comparators. Instrument is relatively simple; time and cost of usual master preparation are largely eliminated.

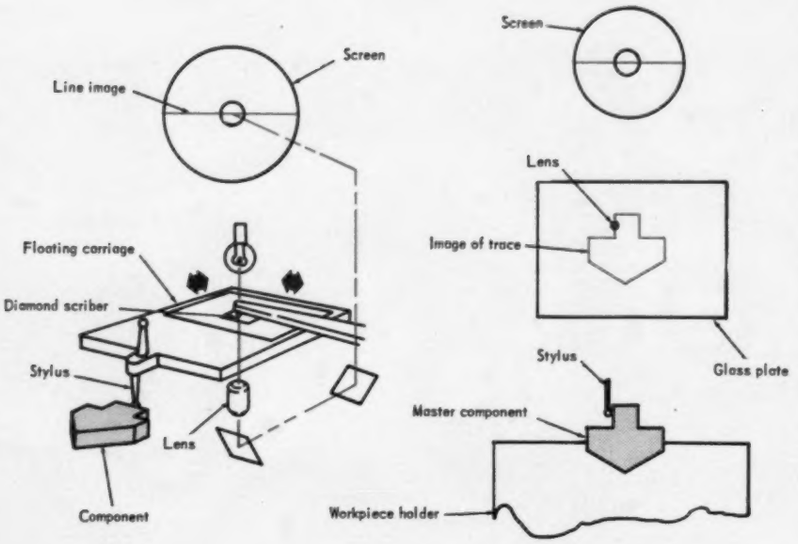
Heart of the device is a carriage, free to move in a horizontal plane by virtue of preloaded ball bearings. Fixed at an edge is a ball-tipped vertical stylus, while the glass plate forms a major part of the carriage's horizontal surface. When the stylus is guided around a separately mounted master, a diamond scriber is lowered to the glass to cut a 0.0001-inch trace through the metal coating.

Removal of the scriber permits the optical system, exactly focused on the plate at the scribing point, to display a magnified image of a small line segment. If the stylus is then guided around a test component substituted for the master, the screen display will show the master trace varying around the datum point. The deviation is proportional to the difference between master and test component dimensions, and depends on magnification used. Tolerances are marked as circles on the screen, and if line passes outside, part is rejected.

Designated "Optotrace", the instrument was developed by J. E. Baty and Co., Ltd., Burgess Hill, Sussex, England.

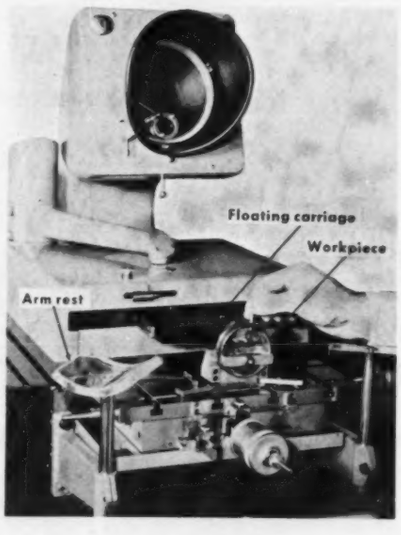


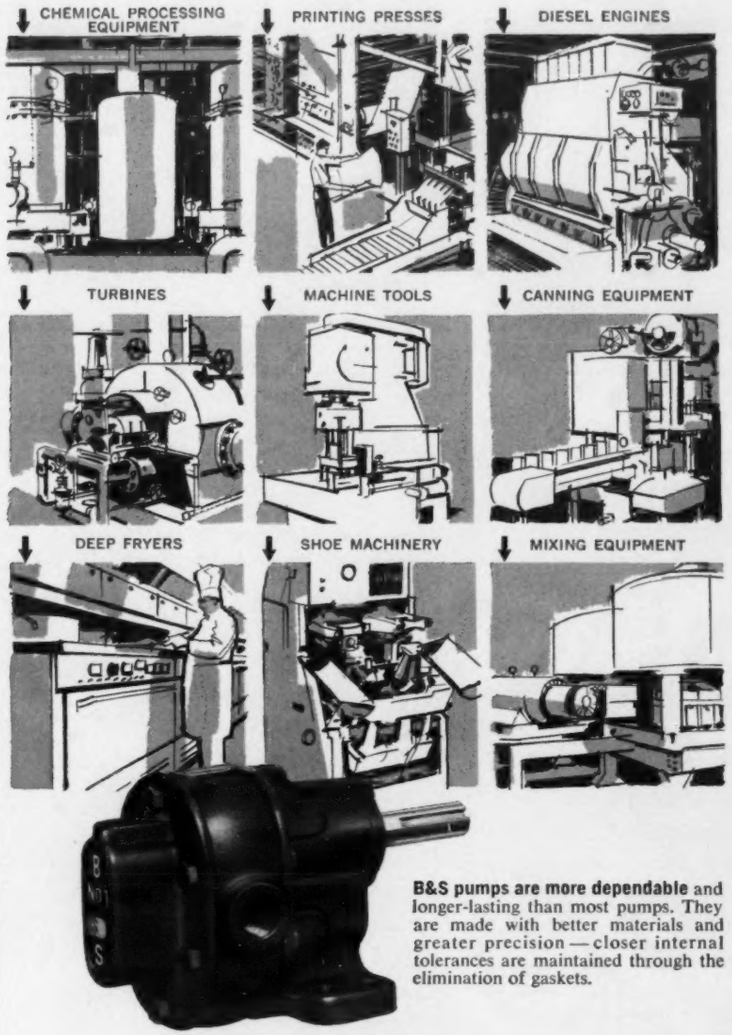
Comparator Also Scribes on Coated Plate



SIMPLIFIED SKETCH shows table as only moving element. Small-field lenses are used, since they must resolve only short segment of fine line. To insure clean cut, air jets clear debris from scriber. Example for obtaining master trace assumes tolerances of all faces as ±0.003 inch. A circle is drawn around screen datum point with a radius of 0.003-inch times magnification used. This is tolerance zone. Trace should not go out of circle when piece is being tested.

MARKING DEVICE is removed when instrument is used for inspection. Two micrometers allow scriber arm to be adjusted in both coordinates to compensate for errors in master. Micrometer drums read to 0.0001 inch and permit diamond position to be adjusted within range of ±0.25 inch. It is not necessary to have perfect master component to make accurate trace; micrometer adjustment makes it possible to apply corrections when tracing from master with known errors.





B&S pumps are more dependable and longer-lasting than most pumps. They are made with better materials and greater precision — closer internal tolerances are maintained through the elimination of gaskets.

See how a Brown & Sharpe Pump gets around!

You'll be amazed how often Brown & Sharpe "standard" pumps can take your "special" jobs in stride — at low cost — with little or no modification. For instance:

The popular Models 1, 2, 3, 4, 1S, 2S, 3S Rotary Gear Pumps are used for everything from acids, to oils, to molten lead. Suitable for pressures to 200 psi; cap., to 26.8 gpm; viscosities, 32 to 50,000 ssu. Available for foot or flange mounting; with or without integral relief valves. Before you pump anything . . .

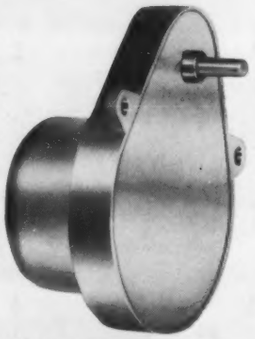
Check B&S standard pumps first! And if they won't do the trick, ask us about a special. Brown & Sharpe Mfg. Co., Providence 1, R. I.

Brown & Sharpe
PRECISION CENTER

Circle 22 on Reader-Service Card for more information

this unique variable pole arm development

. . . in the NEW VP III MOTOR



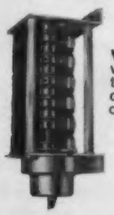
assures 100% STARTING RELIABILITY

To build your product better . . . or develop a new one . . . choose the VP-III synchronous motor. It's the only permanent magnet motor that starts *instantly* — even when rotor poles are in dead-center position.

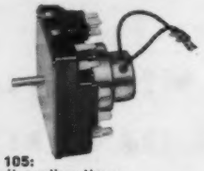
The VP-III motor's reliable starting characteristics stem from a unique, L-shaped variable pole arm. Whenever the poles of the rotor are dead-center, the field coil induces magnetism in this arm to turn the rotor.

Positive lubrication, heavy duty gear train and high output torque are added reasons why the VP-III motor helps you design better electromechanical devices. Write for bulletin.

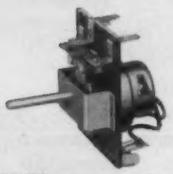
Put greater promise in your product . . . specify precision Lake City timers, powered by VP-III motors for absolute reliability —



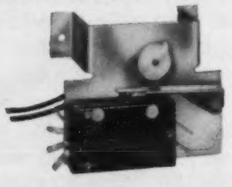
VC-300 variable cam timer, with one to eight circuits.



MODEL 105: 1-6 circuit cycling timer; positive-stopping design.



CD-100: compact, 1-2 circuit timer; dust cover optional.



GT-100: general purpose timer with single DPDT or SPDT switch.

LAKE CITY, INC.
A SUBSIDIARY OF CONTROLS COMPANY OF AMERICA
CRYSTAL LAKE, ILLINOIS
LC-3-61

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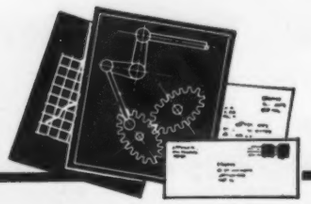
IDEA MART
DESIGN NEWS

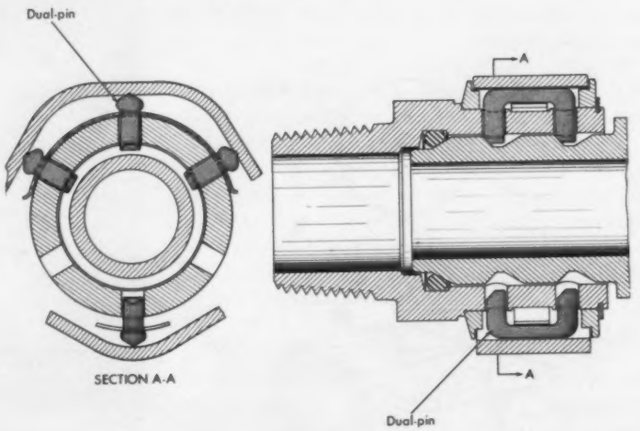


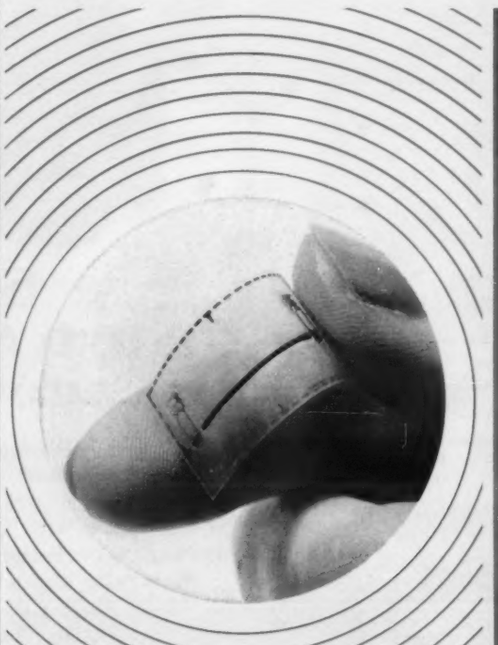
AVAILABLE

Quick-Disconnect Coupling

Purpose of this design is to overcome difficulties in more conventional ball or single-pin designs. Dual-pins are made from annealed spring wire, bent and die-formed to the shape illustrated. Flats on the pins are formed with a curve which produces an exact fit with flanges on the nipple portion of the coupling. The dual-pins fit in reamed holes in an axial plane and may be used in groups of three or six.

The dual-pin construction eliminates difficulties with ball or single-pin type. In ball types, the small area presented permits "brinelling" when subjected to high pressures. The dual-pins are sufficiently rigid to maintain their position normal to the axis of the coupling. Each dual-pin is self-equalizing under cam action. Write IM 508, Idea Mart, DESIGN NEWS, 3375 S. Bannock, Englewood, Colo.





MICRO-STRESS INSTRUMENTATION
Orders of Magnitude More Sensitive
SEMICONDUCTOR STRAIN GAGE
MICRO-SENSOR MS 105-350

For Application to: Structural Members • Transducer Sensors

FEATURING

- Sensitivity—gage factor 130
- Easily bonded to all types of surfaces for military, industrial, and space applications
- Integral terminal construction
- Superior signal-to-noise ratio
- Resistance—350
- Size: Element—⅜" x .020" Complete Gage—1" x ½"
- Radius of Curvature—½"
- Maximum Operating Strain—over 3000 microstrain

IMMEDIATELY AVAILABLE—
ADDITIONAL INFORMATION ON REQUEST

MICRO SYSTEMS INCORPORATED
305 Agostino Rd., San Gabriel, California
A Subsidiary of Electro-Optical Systems, Inc.

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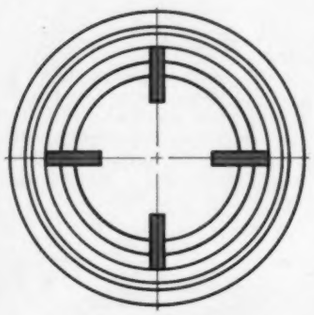
Ideas described in this department are in various stages of development and may be at any point from "initial concept" to "patented".

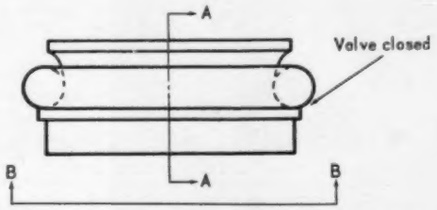
AVAILABLE

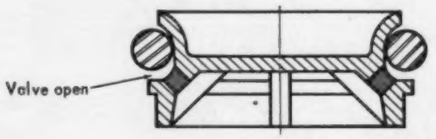
Valve

Tests on this valve show it requires no spring and is very quiet in operation. A valve cage is provided with 45-deg ports, an angle guide and valve bumper in which is mounted an O-ring of rubber or neoprene, depending upon the service required. In water pumps we use "Buna N" of 70 durometer. In operation, the O-ring will roll up the valve guide 1/16 to ⅛ inch in most applications. Because of the incline on the guide, the ring will roll back upon its seat in normal operations. Write IM 510, Idea Mart, DESIGN NEWS, 3375 S. Bannock St., Englewood, Colo.



VIEW B–B





SECTION A–A

LONG-LOK® SELF-LOCKING SCREWS VIRTUALLY ELIMINATE DOWNTIME ON THESE *HIGH SPEED CITRUS JUICE EXTRACTORS*

Each of these stainless steel automatic machines manufactured by Brown Citrus Machinery Corporation, Whittier, California, ream in excess of 700 fruit per minute, produce approximately 500 gallons of juice an hour. Downtime could be very costly. To help avoid such a contingency, Long-Lok Self-Locking Screws were used in the assembly of these machines because: *they are made of stainless steel; they are vibration resistant; they are re-usable.* The result: continuous, trouble-free operation—highest functional reliability. Is there an idea here for your fastener application?

Write for Catalog LL-61

LONG-LOK CORPORATION
4101 REDWOOD AVENUE • LOS ANGELES 66, CALIF.
EXmont 1-7128 • TWX S MON 7146

LONG-LOK EASTERN CORPORATION
68 Urban Ave., Westbury L.I., N.Y., EDgewood 4-8154

Licensees and Representatives in Principal Cities

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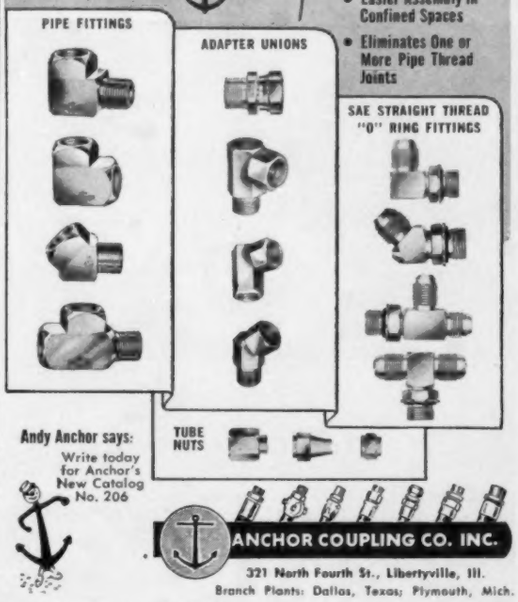
Simplify Your Hydraulic Connections with ANCHOR®

- Prevents Hose Strains Caused by Twisting during Assembly
- Safer, More Positive, Leak-Proof Connections
- Easier Assembly in Confined Spaces
- Eliminates One or More Pipe Thread Joints



Andy Anchor says: Write today for Anchor's New Catalog No. 206

ANCHOR COUPLING CO. INC.
321 North Fourth St., Libertyville, Ill.
Branch Plants: Dallas, Texas; Plymouth, Mich.

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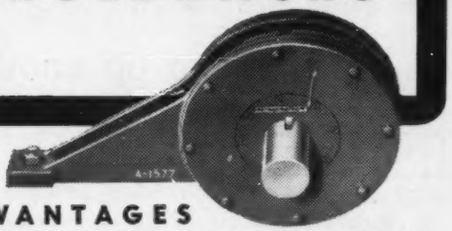
GREATER TONNAGE PROTECTION AT LOW COST WITH... S-A TOTALLY ENCLOSED HOLDBACKS



ADVANTAGES

- Prevents disastrous reversal of heavily loaded belts during power failures.
- Engages without shock . . . Instantly holds . . . Instantly releases when power resumes.
- Eliminates feeder point flooding . . . protects men and equipment.
- Easily installed . . . Economical to purchase, operate and maintain.
- 2 7/16" to 12" bore sizes available.
- Stocked for immediate delivery.

Request Catalog No. 557.

STANDARD PRODUCTS DIVISION
STEPHENS-ADAMSON MFG. CO.
29 RIDGEWAY AVENUE • AURORA, ILLINOIS

PLANTS LOCATED IN: LOS ANGELES, CALIFORNIA
CLARKSDALE, MISSISSIPPI • BELLEVILLE, ONTARIO

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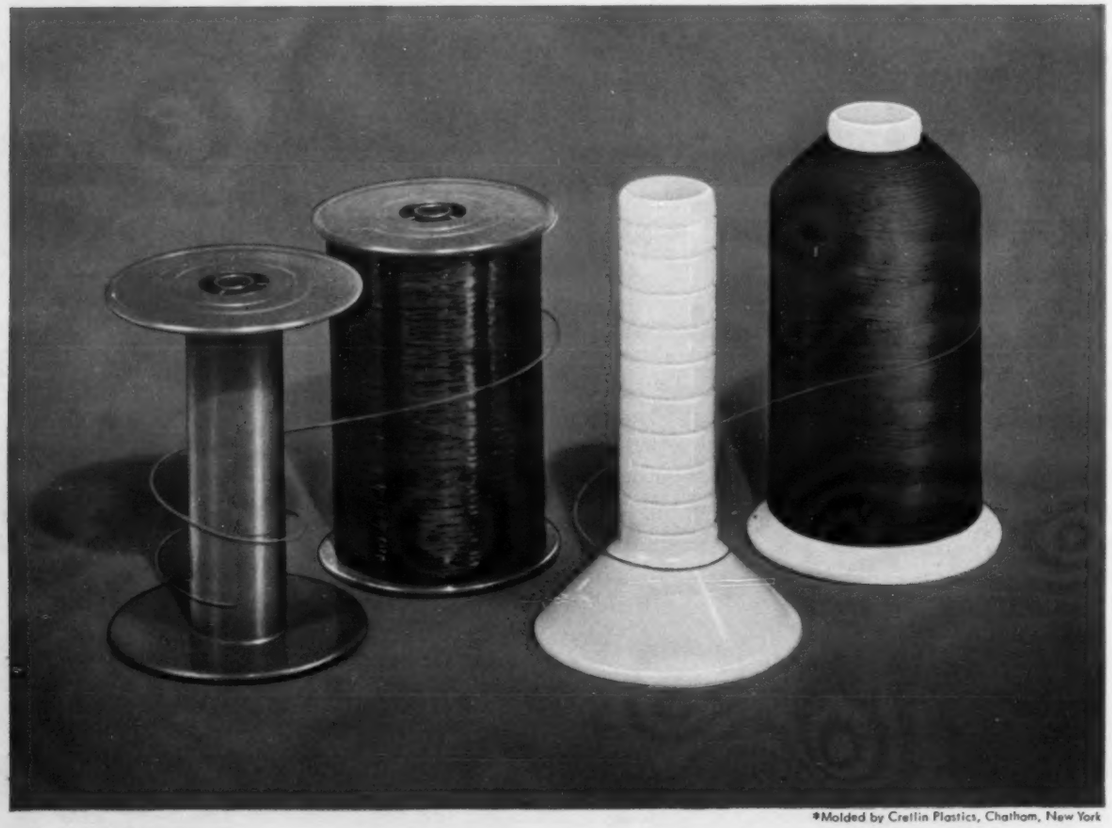
NAUGATUCK CHEMISTRY MAKES THINGS HAPPEN



*Molded by Crellin Plastics, Chatham, New York

Winding up another successful application...

KRALASTIC These spools and tubes*, manufactured for use in the textile industry, had to be tough and rigid, have excellent tensile and impact strength ...exceptional dimensional stability for proper winding... and superior chemical resistance. Kralastic® gives them these properties...provides good cementability as well.

After almost two years of torturous use in winding synthetic yarn and, more recently, metallic thread, not one of these units failed...further proof of how the design possibilities of Kralastic can pay off in practical applications.

Kralastic is available in many colors that eliminate costly finishing operations...end fear of unsightly scratching of finished products. Kralastic weighs less than aluminum, yet, unlike metal, never feels cold or clammy to the touch. Its self-lubricating qualities help eliminate wear, squeaks, and rattles in moving parts.

Kralastic has proved successful in over 16,000 miles of pipe, in lawnmower wheels, hearing aids, automotive instrument panels, and hundreds of other applications...both large and small. For complete technical information on Kralastic—the original ABS resin—write to Naugatuck Chemical, 545 K Elm St., Naugatuck, Connecticut.

NAUGATUCK CHEMICAL DIVISION **United States Rubber**

DIST. OFFICES: Akron · Boston · Chicago · Gastonia · Los Angeles · Memphis · New York · Philadelphia · CANADA: Naugatuck Chemicals · Elmira, Ont. · Cable: Rubexport, N.Y.

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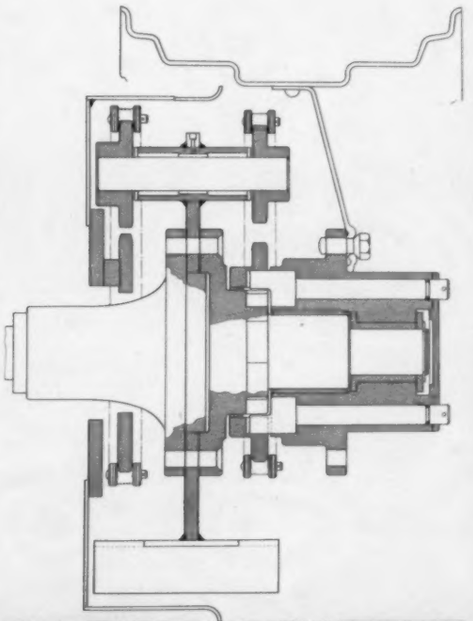
AVAILABLE

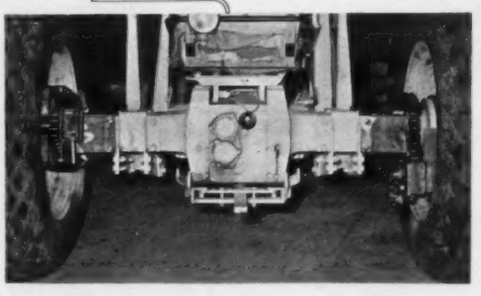
Tractor Speed-Reducing Drive

This creeper drive is designed to reduce tractor speed below that built into the tractor and may be attached to most utility models.

The speed reducing units are designed to locate within 24-inch wheel rims. The units do not affect the tractor transmission or power takeoff drives and there is no interference with rear-mounting attachments.

The speed reducer permits a wide range of speed changes equal to the ratio of gears already provided in the tractor transmission. A steady, positive creeper motion is provided with speed ratios available from 2:1 to 100:1. Shifting out of the creeper range into direct drive is possible and there is no high torque load on the tractor final drive. Normal braking action occurs even with the creeper attachment. The creeper drive is particularly suitable for trenching, tilling and similar applications. Write IM 512, Idea Mart, DESIGN NEWS, 3375 S. Bannock St., Englewood, Colo.



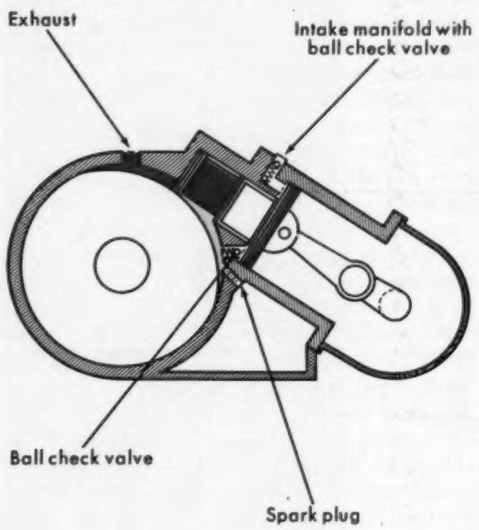


AVAILABLE

Rotary Engine

This engine consists of a rotor mounted in a housing and turning on two tapered bearings, one on each end of the shaft. A piston is mounted in the rotor housing and travels in a groove machined in the perimeter of the rotor. The piston, through its connecting rod and crankshaft, is gear connected to the rotor shaft. Design of the piston is such that the part that enters the rotor groove is smaller than the part used to compress the fuel-air mixture. The piston which enters the groove, with the exception of the ring area, is undercut a few thousandths of an inch so that force of combustion will act on the cylinder wall rather than the piston.

There are two check valves. One valve is located between intake manifold and compression cylinder and the



other is located between compression cylinder and expansion chamber. Products of combustion are exhausted through a manifold located in the front of the edge of the piston.

The illustration shows the rotor at the beginning of power stroke. Power supplied to the rotor, caused by the ignition of the charge, forces the rotor to revolve. As it revolves, the piston is drawn downward, pulling a fuel-air mixture into the cylinder through the check valve in the intake manifold. On the upward stroke of the piston, the mixture is compressed into the expansion chamber (the exposed volume of the groove in the rotor), through the check valve between the cylinder and the expansion chamber. When the piston reaches TDC, or a few degrees before, the charge is ignited, completing one cycle.

The design allows a longer expansion chamber plus maximum torque at all points of rotation. This feature allows maximum horsepower at lower rpm. Write IM 511, Idea Mart, DESIGN NEWS, 3375 S. Bannock Englewood, Colo.

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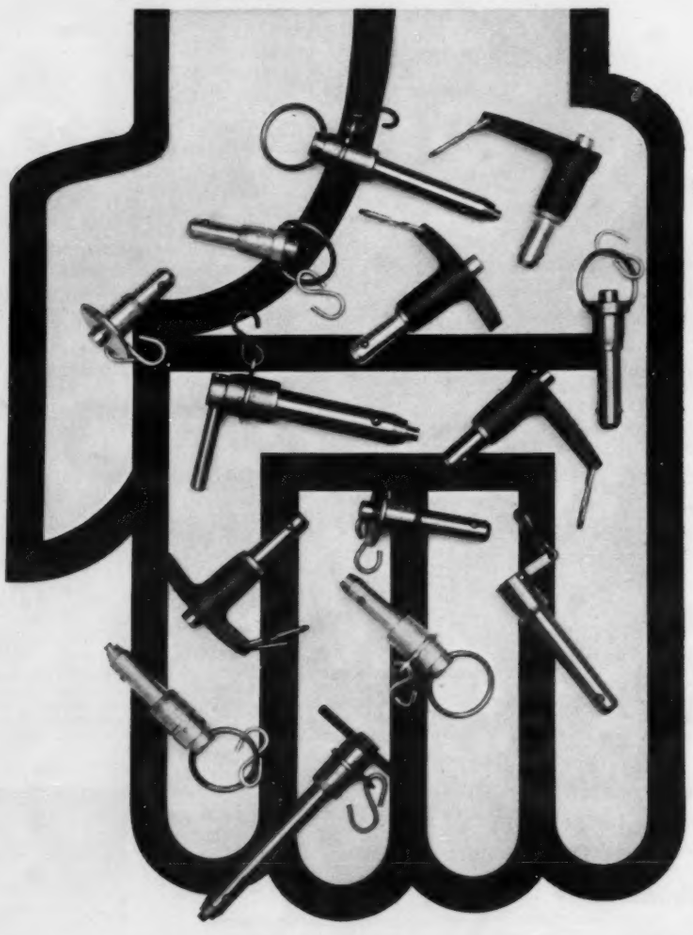

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PATENTS

Automatic Fan Control

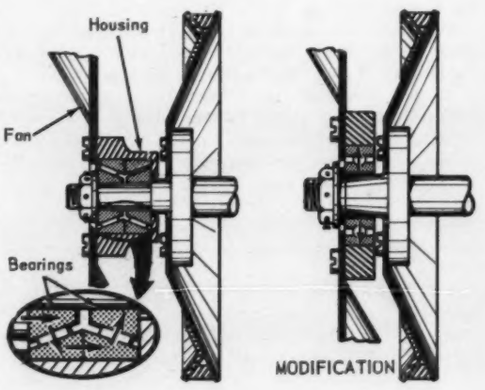
U. S. Patent 2,974,504; Alexander Johnson, Great Neck, N. Y.

This control is designed to be interchangeable with present fan assemblies with little or no alteration. The fan allows higher fan speed at idling and permits a higher pitch angle to be built into the blade.

A drive pulley is attached to the shaft by bolts. Bearings are installed in a housing, the unit is mounted on the shaft and the fan is attached to the housing. When bolts are tightened, the fan forces the outer races of the bearings against the housing. A washer then is placed on the shaft against the inner race of the outer bearing and a nut is screwed on the shaft. When properly torqued, a lateral force is applied to inner races. The force is transmitted outward to the rollers and against the outer race of the bearing. This action causes a lateral force against the outer race of the inner bearing, thence a frictional inward force to the rollers and the inner race of the inner bearing. The nut is locked to the shaft by a cotter pin.

The forces induce a proper amount of friction preload in the bearings. When the shaft is rotated by the engine, driving the inner races, it will drive in turn the outer races through the rollers and thus drive the fan. The fan will turn at a lower speed, depending on rotational speed of the shaft and torque applied to the nut. The lower speed results, because when shaftspeed increases the kinetic coefficient factor of the frictional force within the bearings is decreased and rotational force acting upon the outer races is lowered.

In a modification of the device, a single bearing is used in conjunction with a tapered bushing.



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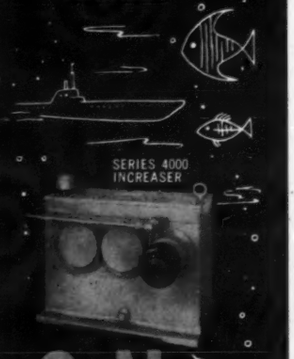

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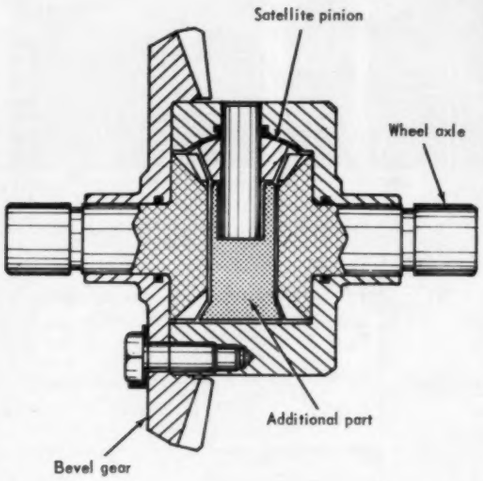
Circle 31 on Reader-Service Card

Progressively Self-Braking Differential

French Patent 1,242,967;
Renault Co., Billancourt, France.

In this patented design, an additional part occupies space left empty in normal differential gear casings. Seals on all external rotating shafts make the unit oiltight. The unit is filled with suitable oil.

Each pinion-axle gear pair acts as an oil pump which drives oil from one space of the mechanism to another, by closed circuits forming themselves in an arbitrary way in the empty spaces. Resistance to this movement, which increases as the speed of the gear pump increases, builds up inside pressure and creates resistance to differential action of the satellite pinion. This resistance, increasing with the differential effect, brakes the



mechanism. When no differential action is occurring, as during straight movement of the car, no oil is pumped and no braking effect is developed. During slow turns, gear-pump action does not build sufficiently high pressure, and braking action is weak. When high differential action results, as on uneven ground or when one of the wheels spins freely and the other is blocked, the differential brakes itself automatically. Torque is applied to the wheel with traction and the vehicle can proceed. The high speed of rotation of the satellite pinions builds up a high pressure in the housing which blocks the differential.

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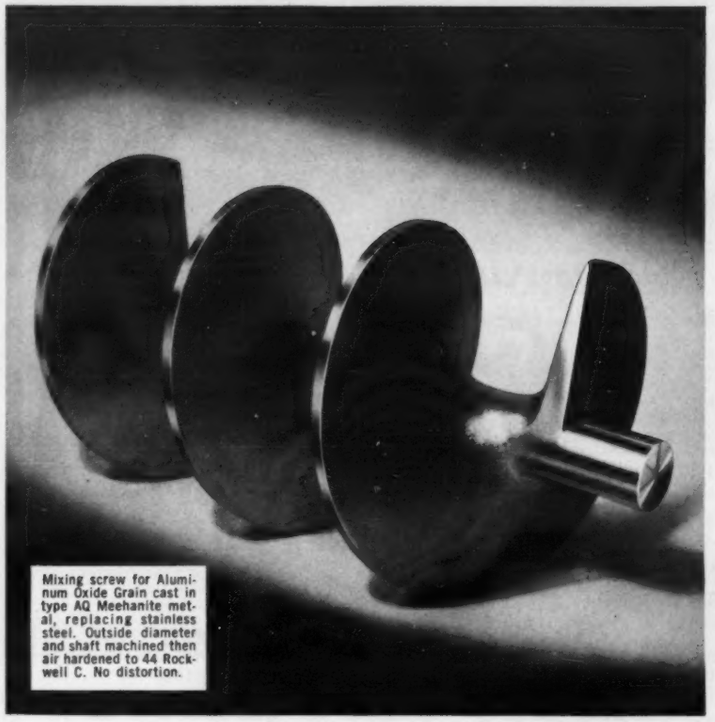

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For more information about AQ Meehanite®, send for your free copy of our 4-page folder, B-48. Write to Meehanite Metal Corporation, 714 North Avenue, New Rochelle, New York.

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AUXILIARY POWER FOR MINUTEMAN'S THREE STAGES

The U. S. Air Force's Minuteman, first of the solid propellant powered ICBM's, introduces numerous design and operational features unavailable in its first generation counterparts. End result is a smaller, lighter, less complex and lower cost missile.

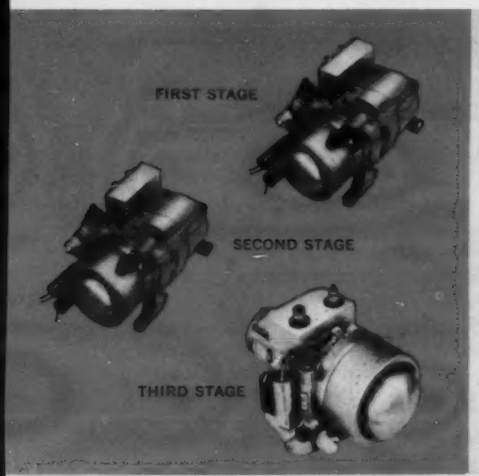
COMPACT DESIGN—Typical of these advances is the highly integrated APU design developed for all three missile stages by Vickers under contract to Autonetics, a division of North American Aviation, Inc. A significant saving in package weight and envelope is provided by immersing the hydraulic pump completely within its self pressurizing reservoir.

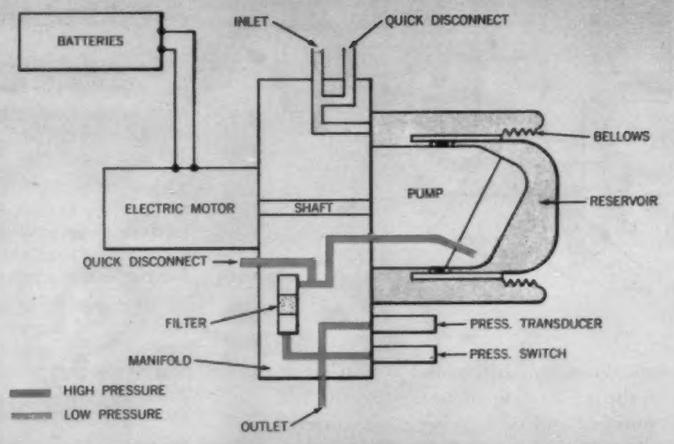
APPLICATION FLEXIBILITY—An important design feature is the ability of the hydraulic pump to be coupled with a wide variety of drives including continuous duty electric motor, ram air turbine, hydraulic motor, flywheel, or be mounted directly on an engine drive pad. For the Minuteman application, an intermittent duty d-c motor is used.

UNUSUAL STORAGE LIFE—A fundamental design goal of the Vickers Minuteman APU was to match the unusual storage life of the missile. This has been accomplished to provide long service-free standby in the missile, coupled with convenient ground check-out.

HIGH RELIABILITY—The schematic diagram below shows the absence of external tubing and the requirement for only one external dynamic seal. These factors along with a proven pumping element and relative low operating speeds have led to a highly reliable system.

This solution is typical of the Vickers "Programmed Power" approach to energy conversion, power transmission and fluid transfer. Get more details on this application by writing for Bulletin A-5249.





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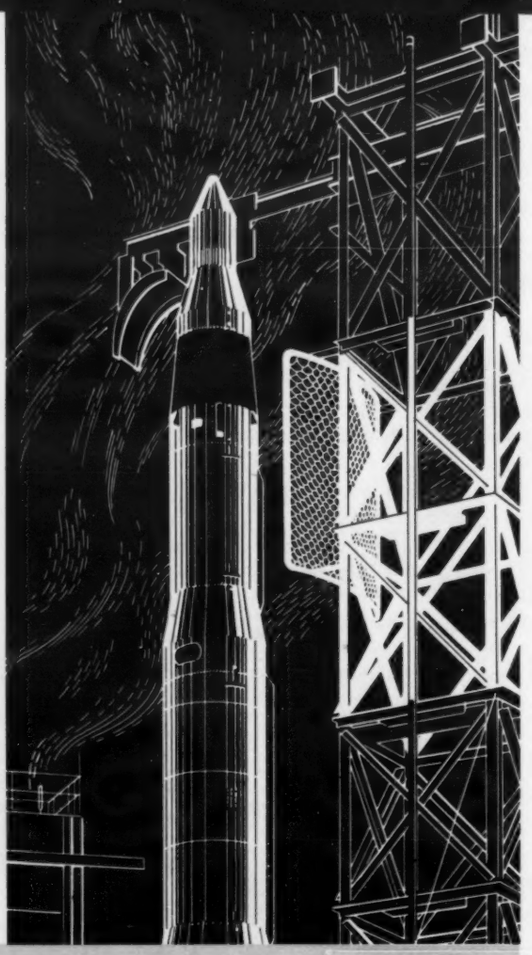


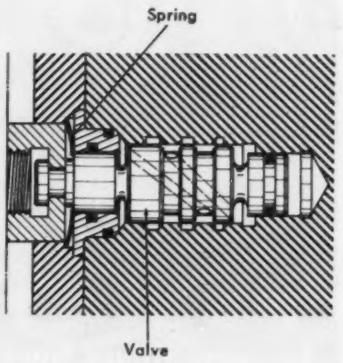
PATENTS

Power-Assist Steering

British Patent 822,064; Charles S. R. Stock, Kings Road, Tyseley, Birmingham, England.

A dished, ring-type spring bears on the end of a control valve to provide automatic compensation for the reactions present in different steering systems. In place of different valves with reaction areas designed to suit particular layouts, a standard valve with equal area reaction surfaces is supplied. It is adapted to differing requirements by changing or reversing the spring, which resiliently resists valve movement in one direction or the other.

Diametrically opposed periphery surfaces of the spring are located against a recess in the outer end wall. The intermediate and inner spring portions bear against a shoulder on the valve extension and the adjacent inner end wall. When the valve moves to the right, the spring is not affected, but when moved to the left, the shoulder engages the spring to provide a force on the valve, supplementary to the fluid pressure reaction. If the steering layout requires force to operate in the opposite direction, the spring is reversed. Its inner edge acts against the valve head adapter to which the steering drop arm is connected.



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The following list compiled from recent issues of the Patent Gazette gives you increased coverage of new patents whose details may be useful to product and machine designers. Copies may be obtained from the U. S. Commissioner of Patents, Washington, D. C. The price is 25c each.

ROTARY OUTPUT ASSEMBLIES
U S Patent 2,978,885; Roger A. Davison, assignor to Orenda Engines, Ltd., Malton, Ontario, Canada.

TORQUE TRANSMISSION COUPLING
U S Patent 2,978,903; Donald C. Nicholas, assignor to B. X. Plastics, Ltd., Highams Park, London, England.

PRESSURE-RELAYING DEVICE
U S Patent 2,978,911; Walter M. Haessler, assignor to The Fyr-Fyter Co., Dayton, Ohio.

MOTION CONVERTER
U S Patent 2,978,916; Herbert E. Metcalf, Malibu, Calif.

TRANSMISSION
U S Patent 2,978,918; Erwin P. Pollitt, Chicago, Ill.

LOCKING DIFFERENTIAL
U S Patent 2,978,929; Albert O. Roberts, Durham, N. C.

ELECTROMAGNETIC PUMPS
U S Patent 2,978,985; Nils E. Lindenblad, assignor to Radio Corp. of America, New York, N. Y.

FLUID PUMPS
U S Patent 2,978,990; George W. Lewis, Toledo, Ohio.

HYDRAULIC ACTUATOR WITH LOAD PROPORTIONAL LOCKING MEANS
U S Patent 2,979,034; Howard M. Geyer, assignor to General Motors Corp., Detroit, Mich.

CONSTANT-SPEED DRIVE
U S Patent 2,979,037; Tadeusz Budzich, Cleveland, Ohio.

PRESSURE REGULATOR
U S Patent 2,979,067; Frank Kern, Jr., and Charles Stang, Jr., assignors to Maxitrol Co., Detroit, Mich.

ROTOR BRAKE ARRANGEMENT
U S Patent 2,979,164; Russell G. Altherr, assignor to American Steel Foundries, Chicago, Ill.

FLUID-DRIVE MECHANISM
U S Patent 2,979,306; Edward Maye, Falls Church, Va.

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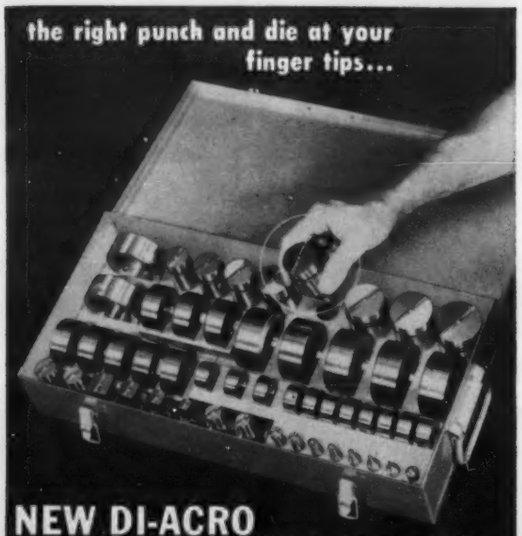

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DIMENSION DATA

All Di-Acro Punches to ½" have ½" diameter shanks, 2 13/32" length.
All Di-Acro Punches from ½" to 2" have 1" diameter shanks, 3⅛" length.
All Di-Acro Dies to ¾" are 1¼" diameter, ⅝" high.
All Di-Acro Dies from ¾" to 1⅜" are 2⅛" diameter, ⅞" high.
All Di-Acro Dies from 1½" to 2" are 2¾" diameter, 15/32" high.

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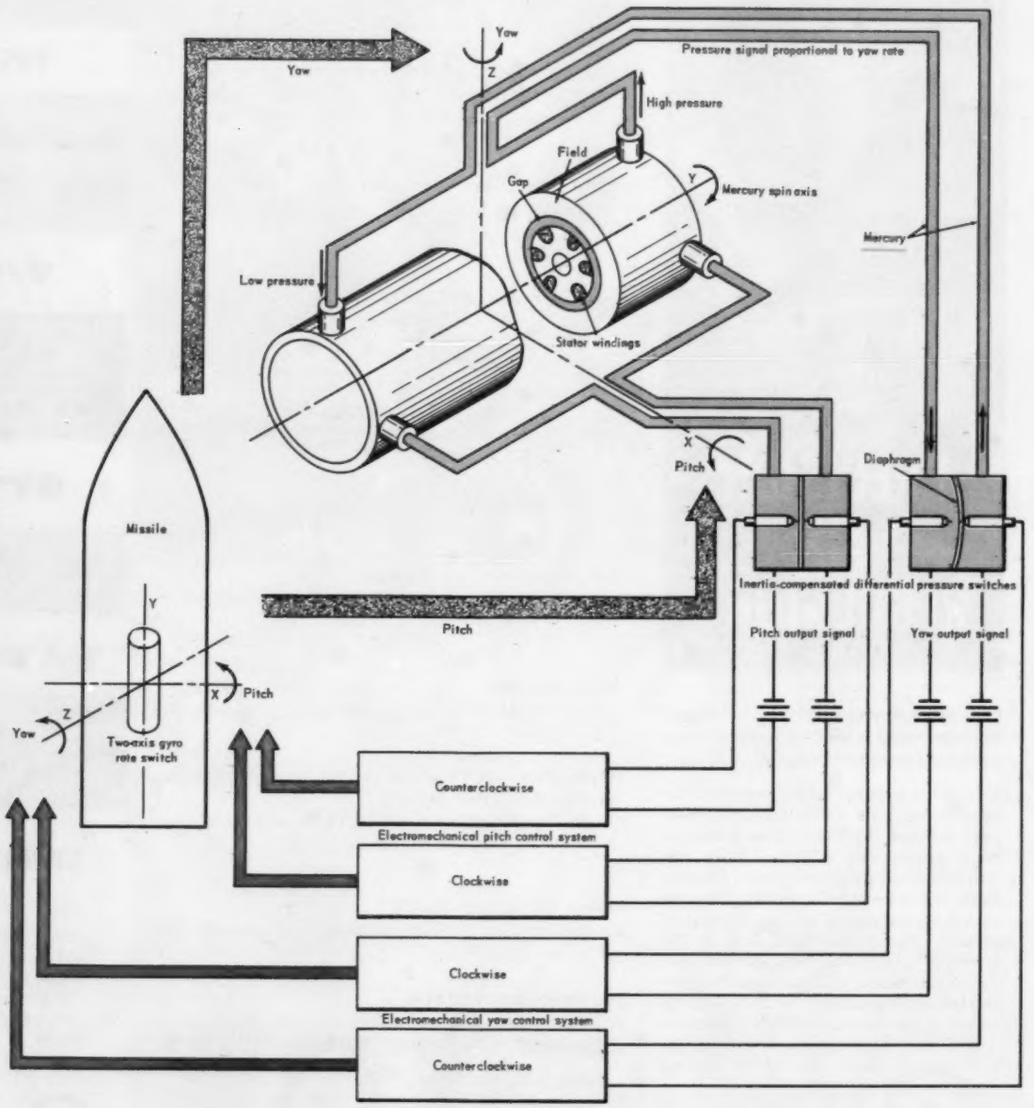
DESIGN IDEAS NEWS

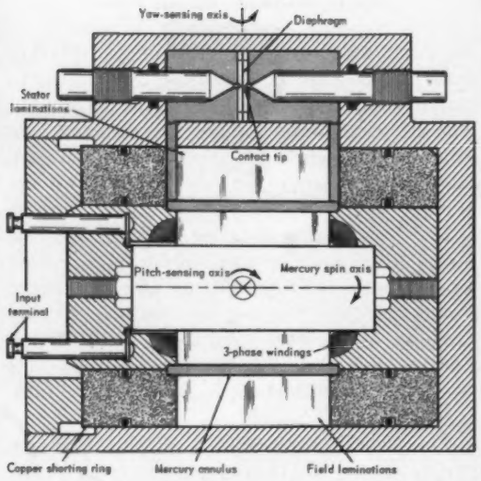
ELECTRICAL

Liquid Rotor Simplifies Gyro Construction

Victor W. Wigotsky, Eastern Editor



SPIN AXIS OF GYRO is aligned with longitudinal axis of missile. Gyro is now able to sense pitch and yaw motions and provide output signals for these inputs. For example, missile begins to turn about yaw axis in counterclockwise direction at rate of 5 deg per sec. Pressure builds up in rotating mercury along gyro longitudinal axis and actuates rubber diaphragm toward metallic contact. Electrical circuit is then opened. Switching action is used to operate actuator of valve which controls flow of jet to stop missile's counterclockwise rotation.



PRESSURE SWITCHES are integral with gyro body. Stainless-steel body and silicone-rubber O-ring seals, gaskets and diaphragms prevent chemical attack by mercury and satisfy high-temperature requirements. Conducting contacts in mercury are made from fine wire insulated at all points except at tips covered by diaphragms.

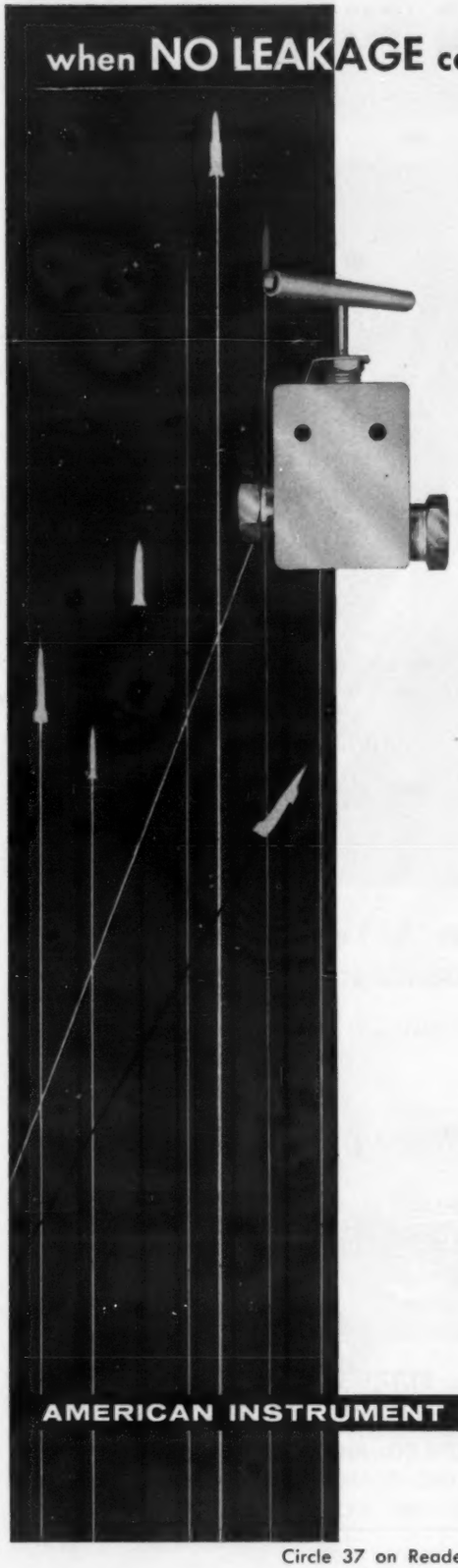
An electrically conductive fluid is a liquid rotor in a magnetohydrodynamic gyroscope. The device detects rates of turn about either the yaw or pitch axis or about both axes simultaneously.

Mercury is contained in an annulus formed by the inner surface of a magnetic sleeve and the outer surface of a magnetic cylinder. Under normal operation the conducting fluid is driven around the closed annular path by a rotating magnetic field. However, rotation of the gyro about an axis other than the fluid spin axis causes a pressure gradient from one end of the fluid annulus to the other. Differential pressure switches then sense the appropriate pitch or yaw signal and convert it to an electrical output.

Objectives in the gyro design included elimination of potential errors caused by mass unbalance and bearing wear, which could occur with solid rotor gyros. The gyro can operate under extreme environments and requires no precision balancing or close tolerances. Use of the conducting fluid as a liquid rotor thus provides a rugged and simple design.

The magnetohydrodynamic gyroscope was designed by Research and Development Div., Speidel Corp., Providence, R. I.

when NO LEAKAGE can be tolerated at gas pressures up to 20,000 p.s.i.



HERE'S YOUR VALVE!

Before introducing this new group of valves commercially, Aminco contracted with Wyle Labs, El Segundo, Cal. to subject prototype units to the rigid U.S. Air Force Evaluation Test Specifications for Propellant Loading (AMC, Ballistic Missiles Div.), and render a performance evaluation report. The test included internal- and external-leakage and proof cycle tests throughout 500 operating cycles. The Wyle program confirmed Aminco's pre-production tests . . . valves operated easily, and with COMPLETE FREEDOM FROM LEAKS, not only internally at the valve stem seat, but also around the valve packing.

The valve is well-suited for severe service and where absolute freedom from leakage, from excessive stem wear, and from packing deterioration are MUSTS. The valves embody a floating non-rotating stem tip which prevents the possibility of forcing the stem into the seat. Four models are available for applications ranging from the propellant loading of missiles to chemical and petrochemical plant service. Valves are easy to install . . . easy to operate. Bodies are constructed of 316-stainless steel; trim is of 400-series stainless steel except the packing gland nut which is of aluminum bronze.

IMMEDIATE DELIVERY

All four types are available from stock . . . all valves have 5/16 in. port openings, and are designed to accept 9/16 in. o.d. x 5/16 in. i.d. tubing. Dimensions common to all four styles: width, 2½ in.; body thickness, 1½ in. Packing is a compression-type, glass-filled fluoroplastic flat ring. All styles are furnished complete with necessary nuts and sleeves.

Order by Catalog Number:

44-1317 Two-way Thru Type Valve—As described and illustrated above. Height of valve body, 2-15/16 in.; over-all height, 5¾ in.

44-1337 Two-way Angle Type Valve—With port on one side and on bottom of valve body. Height of valve body, 3-3/16 in.; over-all height, 6 in.

44-1377 Three-way Offset Cross—As illustrated above but with an additional port on the bottom of valve body. Height of body, 3⅝ in.; over-all height, 6-7/16 in.

44-1357 Three-way Cross Type Valve—With a port on each side of valve body, located in line, and a third port on the bottom. Height of body, 3-3/16 in.; over-all height, 6 in.

AMINCO

AMERICAN INSTRUMENT CO., INC. 8030 Georgia Ave., Silver Spring, Md.

NEW BULLETIN

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INDUSTRIAL ENGINE DEPARTMENT, FORD DIVISION, FORD MOTOR CO., P.O. BOX 598, DEARBORN, MICH.

West of Rockies write to:
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→ FORD INDUSTRIAL ENGINE DEPT., P.O. BOX 1666, RICHMOND, CALIF.

Circle 38 on Reader-Service Card for more information

Miniature Switches Control

Lars G. Soderholm, Midwest Editor

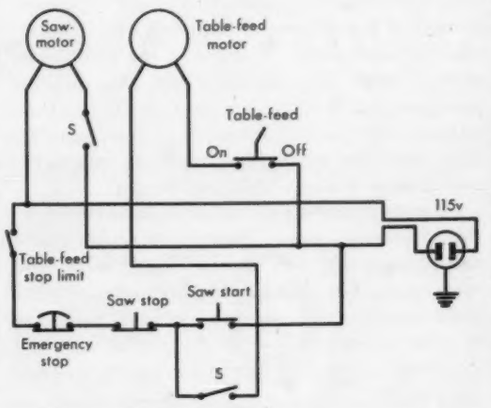
An exact scale working model of an 11,000-lb band mill uses special miniature components to permit actual sawing similar to the large unit. The electrical control circuit uses standard sub-subminiature switches to provide saw stop-start, table feed stop-start and table limit-switch operation.

The construction of a small, one-sixth scale model of this machine tool was begun to provide a sales tool in the form of a portable model that would show and demonstrate just like the big machine. The size was determined by the smallest possible band wheel for a specially made, 24-pitch blade, 0.010 inch thick, 3/8 inch wide and 36 inches long.

The blade is powered by a 1/20-hp, 1500-rpm motor through an O-ring speed-reducing pulley to provide a blade speed of 400 surface fpm. The work table is moved by a mechanical lead screw powered by a 1/250-hp, miniature motor-reducer also through an O-ring pulley to turn the lead screw at 25 rpm. Table feed speed is one ipm.

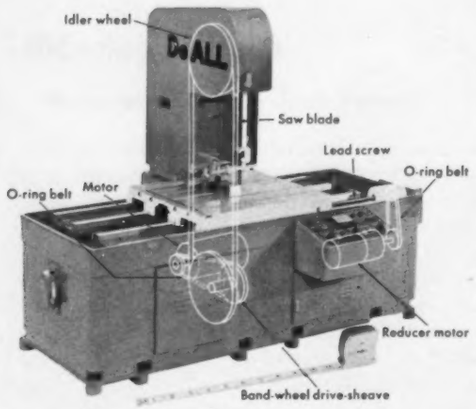
All operations are controlled from a console at the front of the machine. The standard "Micro Switch" sub-subminiature switches are about the size of a pencil eraser and so were able to fit in the space inside the console housing.

The model is constructed from aluminum castings. Nylon gibs and "Teflon" facings are used to reduce friction as the table moves along the ways.



SUB-SUBMINIATURE SWITCHES made by Minneapolis-Honeywell's Micro Switch Div. control blade and feed motors and cut-off limit switch.

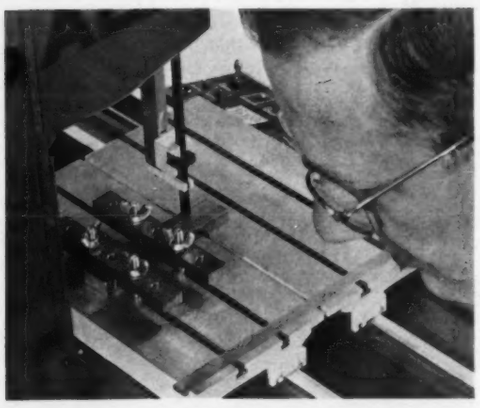
One-Sixth Size Model Band Mill



WORKING MODEL saws aluminum block at 400 sq fpm blade speed and 1 ipm table feed. Miniature ball bearings back up blade.

While the dimensions have been reduced to one-sixth those of the large machine, the weight has been trimmed even more, so the model weighs only 60 lb. For demonstration purposes the model is used to saw aluminum and plastic workpieces. The model machine, incidentally, was used to saw its own gibs as the model was in process of being assembled.

The model saw is 22 inches long, 20 inches high and 18 inches deep. It is an exact reproduction of the DoAll 2624-5 Band Mill and was made by Continental Machine, Inc., Savage, Minn., for the DoAll Co., Des Plaines, Ill.



The Temperature Control Powered by the

IRREPRESSIBLE FORCE OF MERCURY–

for Accuracy with Rugged Dependability

All Partlow temperature controls are directly and positively actuated by mercury, the metal in liquid form whose reaction to changes in temperature is as predictable as it is powerful.

Unlike delicate electronic controllers, the mercury-actuated Partlow requires no outside power source. No amplifiers. No finicky levers. And no "babying"! With a Partlow you can be sure of getting accurate, dependable control even under extreme conditions of shock and vibration.

Mercury-actuation makes possible maximum design efficiency and simplicity too. The Partlow has fewer parts to go wrong. And fewer service problems (with less "down" time) should trouble occur. You can replace the thermal element of any Partlow control instantly, right at the job site, without recalibrating, fitting or factory adjustment.

Whatever the process or application, you'll find a Partlow temperature control to fit it dependably, economically, *precisely*. Mail coupon today for full details.

PARTLOW
TEMPERATURE CONTROLS
World Export:
Ad. Auriema, Inc., 85 Broad Street, New York 4, N. Y.

THE PARTLOW CORP., Dept. K-561
NEW HARTFORD, N. Y.
Please send condensed Catalog of Partlow temperature controls and allied equipment for industrial heating and refrigeration.

Name and Title .....
Company .....
Address .....
City and State .....

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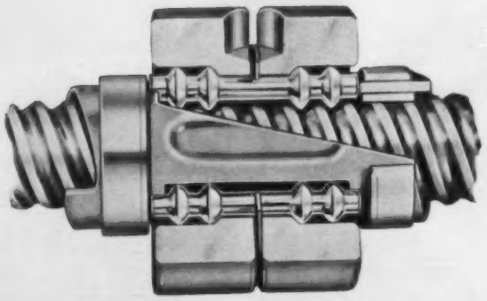
NEW PRODUCTS

Circle number on Reader Service card for more information.

Antifriction Bearing Fastener 301

Features 'Freewheeling' Motion



The planetary-drive-type bearing screw provides planetary action of the caged bearings around the screw which results in a mechanical reduction of linear advancement relative to screw lead. The drive also features "freewheeling" motion at end of travel, which affords complete protection to bearing-screw assembly, motor and intervening gears. The drive assembly is useful for applications which require a fixed relationship between linear advancement and input revolutions, and is adaptable to multiple screw applications requiring synchronized advancements. With either type of drive action—planetary or positive—the bearing screw accomplishes conversion of force and motion with high operating efficiency and provides economy of space, weight, power and cost, plus ease of installation and reliable performance. These advantages make the "Roton" antifriction bearing fastener suitable for a variety of mechanically actuated products—hand-operated or power-operated.

Anderson Co., Roton Products Div., Gary 40, Ind.

12-Speed Instrument Drive 302

Operates Permanently in Either Direction

Positions	1	2	3	4	5	6	7	8	9	10	11	12
Reduction ratios (not variable)	10-1	25-1	50-1	100-1	200-1	500-1	1000-1	2000-1	5000-1	10,000-1	20,000-1	50,000-1
Output speeds (rpm)	60	24	12	6	3	1.2	.6	.3	.12	.06	.03	.012
Output torques (in. oz. max.)	5	12.5	25	50	100	250	300	300	300	300	300	300

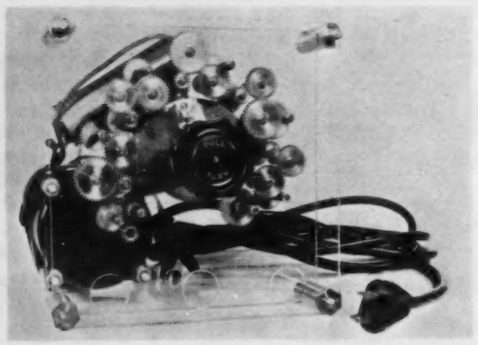


TABLE shows ratios and speeds obtained with standard drive equipped with standard 600-rpm synchronous motor. Other output speeds can be obtained through use of different motor and/or tandem bearing.

The various speeds of this fractional-horsepower unit are obtained by shifting gears with the "pull-and-turn" knob to any one of the 12 positions. This can be done while the unit is operating. The drive can be operated permanently in either direction or can be equipped with your own reversing switch when installed. Panel mounting of the device may be direct or in a recessed hole measuring 6 by 6 by 5 inches deep. The 0.250-inch dia output shaft extends 1 inch from exact center of rear bearing plate and parallel to motor shaft. Maximum recommended input speed, when drive is used in conjunction with a motor other than 600 rpm, is 3600 rpm. Gears will withstand 300 oz-in of load at output shaft.

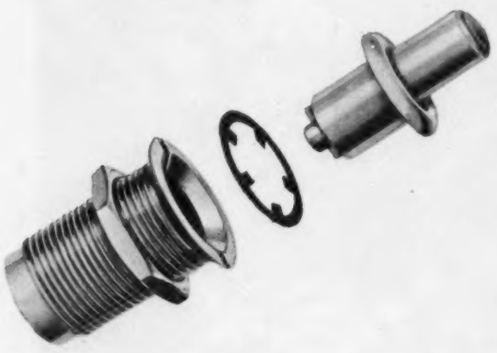
Actuator Products, Div. of Geartronics Corp., 40 Nashua St., Woburn, Mass.

Push-Button Fastener 303

Permits Rapid Panel Access

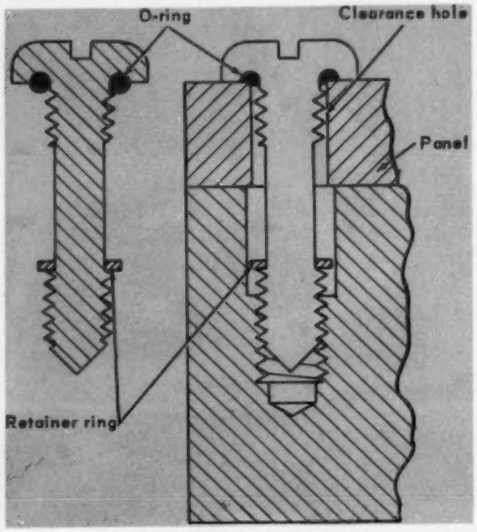
A quick-mounting, compact, push-button fastener for rapid access to panel assemblies, cabinets and components requires only single-hole mounting and eliminates rivet holes and special tooling for installation. The fastener is reported to incorporate a unique locking action for positive locking and release with minimum finger pressure. One push locks fastener and a second push releases it. The 0.060-inch grip increments will minimize tolerance build-up for manufacturers of precision equipment requiring either single or multiple fastener applications.

Camloc Fastener Corp., 52 Spring Valley Rd., Paramus, N. J.



Self-Sealing Fasteners 304

Accommodate 1/4-Inch Panels



Self-sealing captive screws are available in thread sizes from 2-56 up to ¼-20. Only one length is required for each thread size. Each size will accommodate all panels or covers from 1/32 to ¼ inch thick. No tapping of panel or special tools are required for installation and fasteners can be used in standard clearance holes. Standard pan-head screws in stainless steel with silicone-rubber O-rings are normally stocked, but "KaptOskrews" can be supplied in other head types and materials on special order. Fasteners employ a grip ring on the blind side of the panel as a retaining device. Easily slipped into place, this grip ring not only prevents accidental unscrewing but also eliminates the need for special thread tapping of panels and prevents accidental cross-threading or thread locking. Fasteners will seal internal and external pressures in excess of 500 psi and may be tightened and loosened many times without losing the seal.

A. P. M. Corp., 41 Honeck St., Englewood, N. J.

Gasket engineering

GASKET GAUGE VS. TORQUE RETENTION

Gasket thickness is one of several factors affecting retention of initial torque loads. New study indicates significance of minor variations in gauge.

E. M. SMOLEY
Research Physicist
Armstrong Research and Development Center

Significant variations in the torque retention of a gasket material result from relatively small changes in thickness. This is one of the conclusions of a general study of the torque-retention problem made at the Armstrong Research and Development Center.

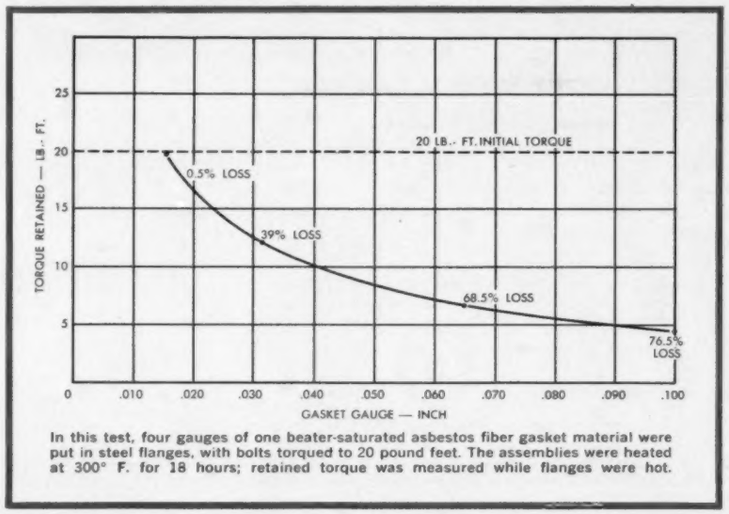
Generally, this work confirmed the widely accepted idea that maximum torque retention is usually obtained by using the thinnest gasket possible. But the magnitude of variation produced by changes in gauge was greater than had previously been estimated.

One phase of the study is charted above. In this curve, retained torque is plotted along the vertical scale, and uncompressed gasket thickness is indicated along the horizontal scale. The initial bolt torque was 20 pound feet for each of the gauges tested.

In the test, each different gauge of the material was bolted between steel flanges, and the assemblies were placed in an oven at 300° F. for 18 hours.

Torque was then re-measured while the flanges were still hot. The thinnest gasket (1/64″) showed an exceptionally low torque loss of only ½ of 1%.

The torque loss rose to 39% for the 1/32″ gauge. The loss for the 1/16″ material was 68.5%.



In this test, four gauges of one beater-saturated asbestos fiber gasket material were put in steel flanges, with bolts torqued to 20 pound feet. The assemblies were heated at 300° F. for 18 hours; retained torque was measured while flanges were hot.

It is estimated that bolts at least 5″ long would be required to eliminate most of the torque loss (76.5%) on the 1/10″ material. Actually, 1″ bolts were used in all these determinations.

In addition to these mechanical advantages, the use of thin gaskets also lowers cost and minimizes extrusion problems.

However, Armstrong engineers point out that there are mechanical factors that limit gauge reduction beyond a certain point. One is that, to provide a seal, gaskets must be compressed more than the cumulative deviation from perfect parallelism of the two flange surfaces.

For example, take a 1/32″ gasket cut from a material capable of a 50% compression. If used where the cumulative inaccuracies of the flanges are more than 1/64″, leaks will result. The alternatives are to use a thicker gasket, or a more compressible material.

Sheet metal or other lightweight flanges that permit bowing between bolts also work against the use of thin gauge gaskets. The bowing can sometimes be compensated by using a thicker gasket or a more compressible material. A more desirable alternative is to build more rigidity into the flange.

Gasket thickness is only one of many factors in gasket engineering that are under continuous study at the Armstrong Research and Development Center.

In the course of this work, we have built up a large library of data on gasket engineering. If you have a problem involving gasket design, selection, or performance, we may already have the answer. We will be glad to make suggestions if you will submit details to us. Write to Armstrong Cork Company, Industrial Division, 7105 Ithaca Street, Lancaster, Pa.

Armstrong GASKET MATERIALS

PRODUCT-DESIGN BRIEFS FROM DUREZ

- **High-impact phenolics for shock environments**
- **Fast forming with thermosetting resins**
- **Fire retardance plus in structural plastic**

Better impact strength

The reverse clutch cone pictured here is molded of Durez 16771, a high-impact phenolic material made with fibrous glass. The cone does duty as a brake against which the steel ring gear of a planetary train is stopped while the transmission is under full power.

In this application, the part is buffeted by murderous static and dynamic friction, developed heat, and the 5000-lb. force of the actuating piston. It must also do battle with the chemical effect of transmission oil.

The test performance proved that the phenolic part does a better job than metal in all respects. You would therefore expect it to do equally well in other shock environments—and you'd be right. A few examples: stud-welding gun, rocket nozzle, compressor support, motor end-bell, washer sheave, missile nose cone.

Durez 16771 abounds in unique advantages, the most valuable of which is its refusal to warp or shrink. You can mold parts to exact dimensions, without needing to allow for shrinkage.

If *you'd* like a closer look at the properties and design advantages of high-impact phenolics, we'd like to send you a reprint of an article written for *Product Engineering*.

A resin that forgets

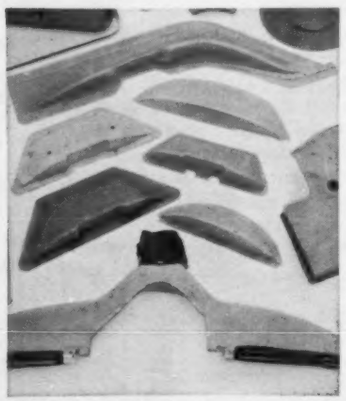
Forgetfulness is a virtue in this material.

It is a prepreg, commonly called "forming board," made from kraft fibers in which Durez phenolic resin has been dispersed as binder. The producer of the prepreg, whose name we'll be glad to send you on request, supplies it in thicknesses ranging from .060 to .150 inch, and in sheet sizes to 55 x 72 inches. A sheet can be stored two years at 70°F without losing its usefulness.

Squeezed at 300-500 psi in a hot press, the prepreg "sets" within 5 to 15 seconds to become a strong, rigid molded shape that will withstand moisture, heat and mild corrosives.

This is where forgetfulness comes in. There is no springback or "memory" effect in this forming board, because as it cures the resin changes its chemical nature to become a different substance, one of great durability.

As you might suspect, there are



many other uses for Durez thermosetting resins of interest to almost anyone developing new products. To get a better idea of how their interesting properties might help you, check the coupon for Bulletin D102, a 12-page idea book.

Delight for designers

Structural paneling which incorporates Hetron® polyester resin in its manufacture is proving a boon to designers concerned with safety and strength . . . a delight to decorators seeking the attractions of color and translucence.

Hetron paneling is fire-retardant. It does not sustain combustion. It offers the added benefits of light weight, un-

breakability, resistance to corrosion and to climatic extremes. It has high strength-to-weight ratio, excellent impact strength and finishing properties.

Other applications of Hetron range from auto fenders to portable hangars for jet aircraft. To enrich your knowledge of this versatile material, we'll gladly send you our Designer's Data File and the names of fabricators.

For more information on Durez materials mentioned above, check here:

- ☐ High-impact phenolic molding material (reprint of article)
- ☐ Thermosetting resins (12-page Bulletin D102)
- ☐ Hetron fire-retardant polyester resin (data file and fabricator list)

Check, clip and mail to us with your name, title, company address.
(When requesting samples, please use business letterhead)

DUREZ PLASTICS DIVISION
2105 WALCK ROAD, NORTH TONAWANDA, N. Y.
HOOKER CHEMICAL CORPORATION

HOOKER CHEMICALS PLASTICS

Circle 40 on Reader-Service Card for more information

Handle Assemblies 305

Any of four handle shapes are covered in leather or vinyl leatherette. An assortment of colors and textures, plus a choice of 16 hardware finishes on steel or solid brass, permits easy incorporation of handle with case design. A concealed core of spring-tempered steel gives strength with flexibility. Vibration-free "Spring-Glides" are engineered for quick attachment to any portable equipment weighing from 20 to 120 lb. Handles attach either by bending prongs on underside of mounting surface or by snap-on clips which lock into notches on prongs. Samples are available.

Philadelphia Handle Co., 1643 Haddon Ave., Camden 3, N. J.

Swivel-Pad Clamp 306

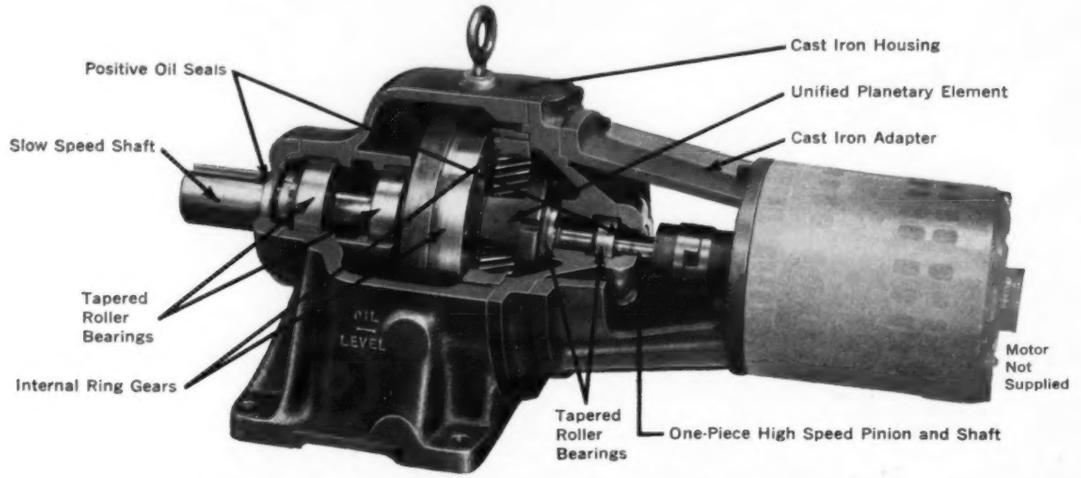
The model SC-324 (10-32 by ½-inch size), socket-set, swivel-pad clamp has been added to the standard line of swivel-pad clamps. This device is used throughout industry for holding parts in jigs and fixtures and in original equipment applications where parts must be securely held without damaging their surface. Similar to other standard models, this unit features a ball-joint pad construction which provides smooth angle adjustment and rotation of pad. Pad swivels 7½ deg each side of center line in all directions to accommodate off-angle surfaces.

Vlier Engineering Corp., 8900 Santa Monica Blvd., Los Angeles 46, Calif.

Engineering Data

WINSMITH SPEED REDUCERS

HORIZONTAL MOTORIZED DIFFERENTIAL SPEED REDUCERS



CAST IRON HOUSING—designed for high heat radiation. One-piece construction, close-grained gray iron for maximum strength and rigidity.

UNIFIED PLANETARY ELEMENT—integral primary and secondary planetary gears, mounted in a ductile iron cage—for even wear, equalized load, smooth operation. Hardened and ground, alloy steel gears carry entire power transmission load.

CAST IRON ADAPTER—permits use of any standard "C" flange motor. Flexible coupling (optional) connects motor to input shaft which can be driven in either direction.

INTERNAL RING GEARS—primary and secondary. Cut from alloy steel, heat treated for wear resistance.

ONE-PIECE HIGH SPEED PINION AND SHAFT—machined from alloy steel with teeth cut integral with the shaft. Hardened and accurately ground to close limits.

SLOW SPEED SHAFT—heat treated, precisely ground alloy steel. Low speed gear web of ductile iron.

TAPERED ROLLER BEARINGS—opposed pairs support the radial load, take thrust, ensure permanent alignment of both input and output shafts.

POSITIVE OIL SEALS—chevron type, keep oil in, dirt out. Oil and heat resistant, non-abrasive, low coefficient of friction.

AVAILABLE in any ratio from 1.1:1 to 50,000:1 without increasing the number of parts. Each model has a range of reduction ratios. Overall dimensions of individual models do not change regardless of ratio.

- *7 Models*
- *.12 to 81.51 H.P.*
- *Ratios 1.1:1 to 50,000:1*
- *Max. Output Torque 50 to 113,000 in. lbs.*

Series HM Horizontal Motorized Speed Reducers are a part of the Winsmith Planetary Differential Reducer line. They feature cut-tooth helical gears of 15° helix angle for smooth, positive power transmission—greater load carrying capacity—larger reduction ratios in smaller, more compact units—minimum wear and long service life. Winsmith Horizontal Motorized Differential Reducers are easy and convenient to install, require no bedplate, deliver more horsepower per pound of weight and cubic foot of space, and permit easier integration with the driven machine.

Write today for complete information or call your nearest Winsmith Representative listed in the Yellow Pages. He is a technically trained expert who is always ready to help you with any speed reducer problem. For both standard and special power transmission applications, you'll find it pays to standardize on Winsmith.

WINSMITH, INC.

200 Eaton Street, Springville, (Erie County), New York

MEMBER OF AGMA

• • • Winsmith Speed Reducers are made by American craftsmen to meet American design and production standards.

Circle 41 on Reader-Service Card for more information

Malleable Puts More Muscle in Machinery

In the agricultural equipment field, reputations depend on building products that can take rough treatment . . . and give real value. To do it, agricultural equipment manufacturers rely heavily on Malleable iron castings.

Malleable's excellent ductility and shock resistance mean longer life and fewer problems than obtainable with fabrications. Low start-up cost for small quantities also is vitally important in this competitive industry.

Put more reputation-building quality into your products at less cost with Malleable. For design assistance or quotations, call any company that displays this symbol —

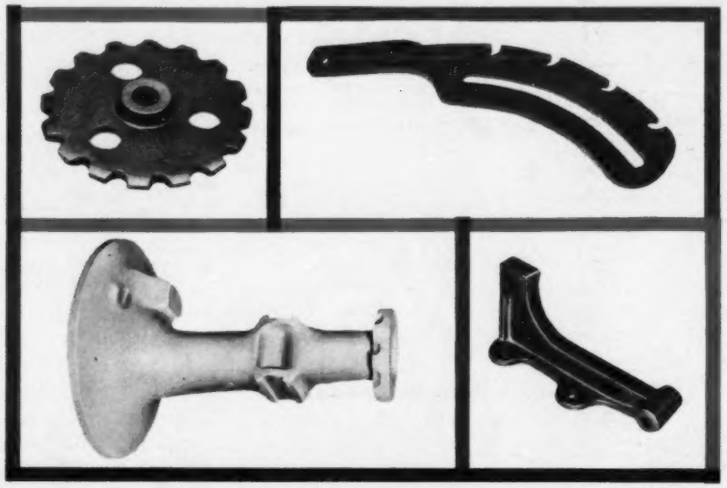
PROBLEM-SOLVING IDEAS are yours free in Data Unit No. 115. For your copy, ask any member of the Malleable Castings Council, or write to Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.

MEMBER
MALLEABLE
CASTINGS COUNCIL

The versatility of Malleable castings is reflected in the variety of ferritic and pearlitic Malleable tractor parts, from the tough, dependable front axle bar to bolsters, lift arms, clamps, clevises, hitches, hinges, foot pedals, transmission planetary carriers and clutch parts.

No machining or hardening is required on this Malleable chain sprocket. It replaces a part cut from steel plate to which a hub was welded. Cost was reduced 12%. Tests verified the excellent performance of the malleable part, and led to a review of the company's entire manufacture of chain sprockets.

Field failures stopped as soon as the manufacturer of this plow quadrant began using a Malleable casting in place of a welded fabrication. This part looks better, works better, and quality is uniform in every piece. Yet the Malleable quadrant costs 22% less than the fabrication.



The strength of Malleable is illustrated by farm tractor rear axle housings. They must absorb the constant shock and strain exerted as heavy implements are dragged over rough fields. Toughness, ease of machining and economy make Malleable first choice for this demanding application.

Costs dropped 59% when this disc harrow ram anchor was converted from a weldment to a Malleable casting. Malleable's shock resistance combined with a better design resulted in a part able to withstand constant punishment.

For Quality and Economy Use

MALLEABLE

For Service Contact...

CONNECTICUT
Connecticut Mall. Castings Co., New Haven 6
Eastern Malleable Iron Co., Naugatuck

DELAWARE
Eastern Malleable Iron Co., Wilmington 99

ILLINOIS
Central Fdry. Div., Gen. Motors, Danville
Chicago Malleable Castings Co., Chicago 43
Moline Iron Works, Moline
Moline Malleable Iron Co., St. Charles
National Mall. and Steel Castings Co., Cicero 50
Peoria Malleable Castings Co., Peoria 1
Wagner Castings Company, Decatur

INDIANA
Albion Malleable Iron Company, Muncie Division, Muncie
Link-Belt Company, Indianapolis 6
National Mall. & Steel Castings Co., Indianapolis 22

IOWA
Iowa Malleable Iron Co., Fairfield

MASSACHUSETTS
Belcher Malleable Iron Co., Easton

MICHIGAN
Albion Malleable Iron Co., Albion
Auto Specialties Mfg. Co., Saint Joseph
Cadillac Malleable Iron Co., Cadillac
Central Fdry. Div., Gen. Motors, Saginaw

MINNESOTA
Northern Malleable Iron Co., St. Paul 6

MISSISSIPPI
Mississippi Malleable Iron Co., Meridian

NEW HAMPSHIRE
Laconia Malleable Iron Co., Laconia

NEW YORK
Acme Steel & Mall. Iron Works, Buffalo 7
Frazer & Jones Company Division Eastern Malleable Iron Co., Solvay
Oriskany Malleable Iron Co., Inc., Oriskany
Westmoreland Mall. Iron Co., Westmoreland

OHIO
American Malleable Castings Co., Marion
Central Fdry. Div., Gen. Motors, Defiance
Dayton Mall. Iron Co., Ironton Div., Ironton
Dayton Mall. Iron Co., Ohio Mall. Div., Columbus 16
National Mall. and Steel Castings Co., Cleveland 6

PENNSYLVANIA
Buck Iron Company, Inc., Philadelphia 22
Erie Malleable Iron Co., Erie
Lancaster Malleable Castings Co., Lancaster
Lehigh Foundries Company, Easton
Meadville Malleable Iron Co., Meadville
Pennsylvania Malleable Iron Corp., Lancaster

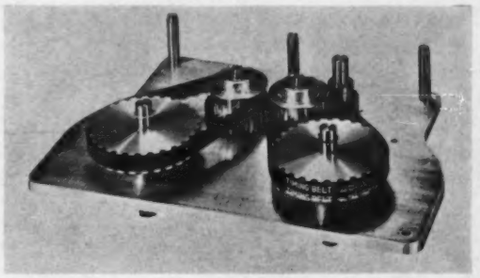
TEXAS
Texas Foundries, Inc., Lufkin

WEST VIRGINIA
West Virginia Mall. Iron Co., Point Pleasant

WISCONSIN
Belle City Malleable Iron Co., Racine
Chain Belt Company, Milwaukee 1
Federal Malleable Company, Inc., West Allis 14
Kirsh Foundry Inc., Beaver Dam
Lakeside Malleable Castings Co., Racine
Milwaukee Malleable & Grey Iron Works, Milwaukee 46

These companies are members of the Malleable Castings Council

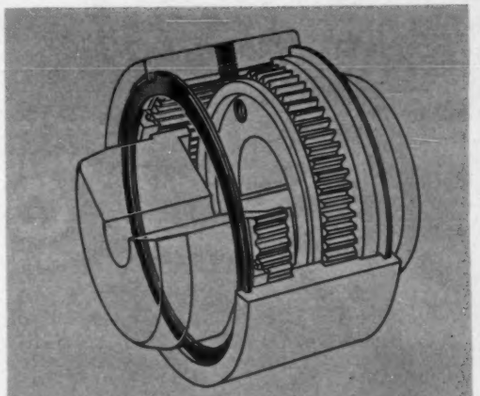
Aluminum Pulleys 307



Special and experimental "timing pulleys" can be produced in the shop or lab with 1/5-inch pitch aluminum pulley stock in 8-inch lengths. This product is designed particularly for model shops, research and development departments and firms which require timing belt drives but cannot use regular standard sizes. Pulley stock may be cut to any size desired. Number of grooves on stock varies from 10 to 36 and pitch diameter is available in sizes from 0.637 to 2.292 inches.

H. Neuman & Co., 8136 N. Lawndale Ave., Skokie, Ill.

Coupling Retaining Rings 308



Heat-treated steel, spiral-type rings maintain a complete 360-deg bearing in retaining groove cut into coupling sleeve and at the same time provide a solid steel retaining wall for the seal. This combination more than doubles the 50,000 lb-in end thrust rating of the previously used snap rings. The complete circle of contact eliminates high spots which wear and weaken rings. Spiral ring is installed easily and removed with a screwdriver.

Sier-Bath Gear & Pump Co., Inc., Flexible Coupling Div., 9250 Hudson Blvd., North Bergen, N. J.

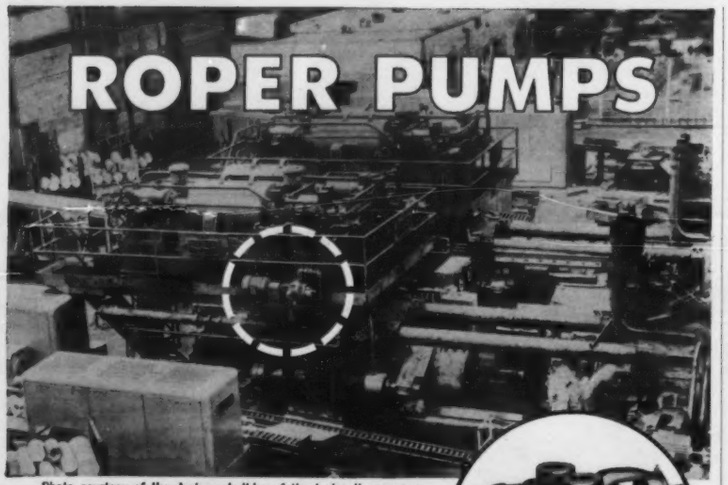


Photo courtesy of the designer-builder of the hydraulic presses

SERIES F Model 2F75 Spec. 35

pre-fill pump brings aluminum extrusion press hydraulic system to operating pressure

1-300 GPM CAPACITIES • OPERATING PRESSURES TO 300 PSI

The hydraulic system of this self-contained oil hydraulic four column aluminum extrusion press, designed and built by Birdsboro Corporation, relies on a Roper Series F pre-fill pump to fill the hydraulic cylinder with oil to operating pressure. The Roper pump was installed as original equipment when the press went into operation five years ago. The 200 SSU viscosity oil is pumped at the rate of 84 gpm and pressure of 125 psi as pump operates at 1140 rpm. Series F pumps are specially designed for transfer of clean liquids in applications such as hydraulic power pressure lubrication or fuel oil transfer. Pump has arrangement for circulation of oil through bearings to control their operating temperature.

INSIDE STORY OF SERIES F

- **PUMPING GEARS:** pair of six-toothed helical gears of heat-treated steel, accurately finished to keep pump running smoothly, quietly.
- **BEARINGS:** two bronze, flange-type bearings on each side give ample support to pumping elements which are self-cooled and lubricated by liquid being pumped.
- **BACKPLATE:** carries pipe connections, designed to permit removal of internal parts without disturbing piping or drive.

For information about your specific pump needs, contact your nearest Roper dealer

Send for "How to Solve Pumping Problems" booklet

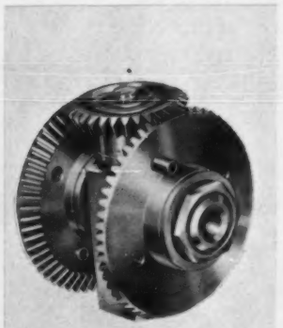
ROPER HYDRAULICS, INC.

Dependable pumps since 1857

COMMERCE, GEORGIA

Circle 43 on Reader-Service Card for more information

Differentials 309



Two models of ⅛-inch, hollow-shaft, mechanical differentials permit interchanging of end gears. Units feature greater flexibility for original design work. One model has a 0.880-inch-dia working circle and measures 0.500 inch across the inside face of end gears. The other model has a working circle of 1.032 inches dia and is 0.563 inch across inside face of end gears. Both models can be modified in backlash and breakaway torque to meet departures from standard performance. Units are available in either a ⅛- or 3/16-inch bore. Now included in the range of differentials is a 1/16-inch hollow-shaft unit, a ⅛-inch standard, two ⅛-inch hollow-shaft models, a 3/16-inch standard, a 3/16-inch hollow shaft, a ¼-inch solid shaft and a 5/16-inch solid shaft. Reproducible tracings of these units are obtainable for use as an overlay in design layout work.

Arch Instrument Co., Inc., 101 Holmes St., North Quincy 71, Mass.

No. 5020
No. 5021
No. 5021-5
Increase your Efficiency!
ALVIN LEAD HOLDER and LEAD POINTER
. . . precision designed for you!
ALVIN MECHANICAL LEAD HOLDERS
• Sure-grip mechanism prevents lead from slipping or turning • Push-button, coil spring action quickly adjusts lead to desired length • Perfectly balanced, featherweight barrel of hard rubber . . . fits hand comfortably for effortless drawing • Modern design in jet black finish and precision made of quality materials for trouble-free service. $1.45 with clip. $1.35 without clip.
PARAMOUNT Drawing Leads in 18 degrees-7B to 9H. $1.00 per tube of 12 leads.
ALVIN PRECISION LEAD POINTER
• Easy-to-operate. Few easy turns quickly sharpens any standard size lead to precise point desired • Retains graphite dust • Keeps hands clean • Fool-proof construction assures years of efficient service. $1.75
Feather Weight only
No. 5000
ALVIN
see your local dealer or order by number . . . TODAY
ALVIN & COMPANY, INC.
Windsor 1, Conn.
Send for ALVIN'S New 124 page CATALOG
DRAWING SETS • DRAFTING INSTRUMENTS & MATERIALS • DESIGNING AIDS • DRAWING EQUIPMENT

Circle 44 on Reader-Service Card for more information

Why is **SPIROL** *the true spring* **PIN** **a more versatile fastener?**

SPIROL PINS are used in a wider variety of materials: To provide spring pins that will not damage, distort or rupture holes even in soft, brittle or thin materials, SPIROL PINS come in MEDIUM and LIGHT DUTY, as well as Heavy Duty for more rugged uses. The entire length of a SPIROL PIN assumes the shape of its hole radially, giving greater shear, shock and vibration resistance. Therefore, MEDIUM and LIGHT DUTY PINS apply where other flexible pins cannot be used.

Where corrosion resistance is needed, SPIROL PINS are the only spring pins stocked in NICKEL STAINLESS STEEL (302). Two sizes are used in the water faucet shown above. **Automatic Assembly:** SPIROL PINS cannot interlock and jam hoppers. Uniform chamfer on both ends speeds inserting pins into holes. **Most complete range of standard diameters:** MINIATURE SPIROL PINS (1/32", .039", 3/64", .052") thru 3/4".

CONNECTICUT ENGINEERING & MANUFACTURING COMPANY, INC.

Write for free TECHNICAL DATA MANUAL. Free samples for specific applications.

C. E. M. COMPANY, INC.
52 School Street, Danielson, Conn. • PRescott 4-8571

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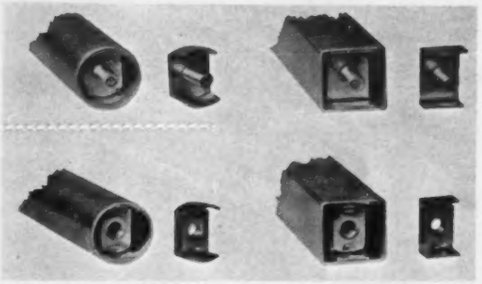
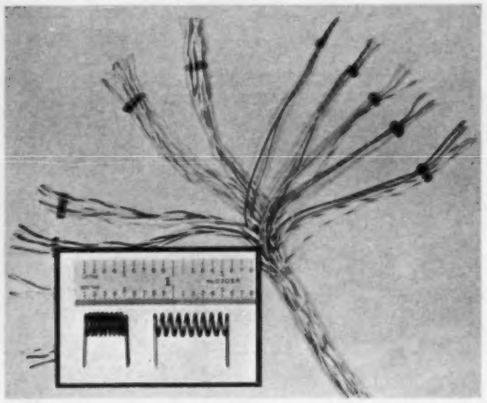
Tubular Inserts 310



Inserts are offered in two-piece welded parts for inserting in round, square or rectangular steel tubing. Fasteners for round tubing are available for diameters from 1 to 1½ inches with internal or external threads. For square and rectangular tubing, sizes range from ⅞ to 1½ inches in width.

Ohio Nut & Bolt Co., 50 First Ave., Berea, Ohio.

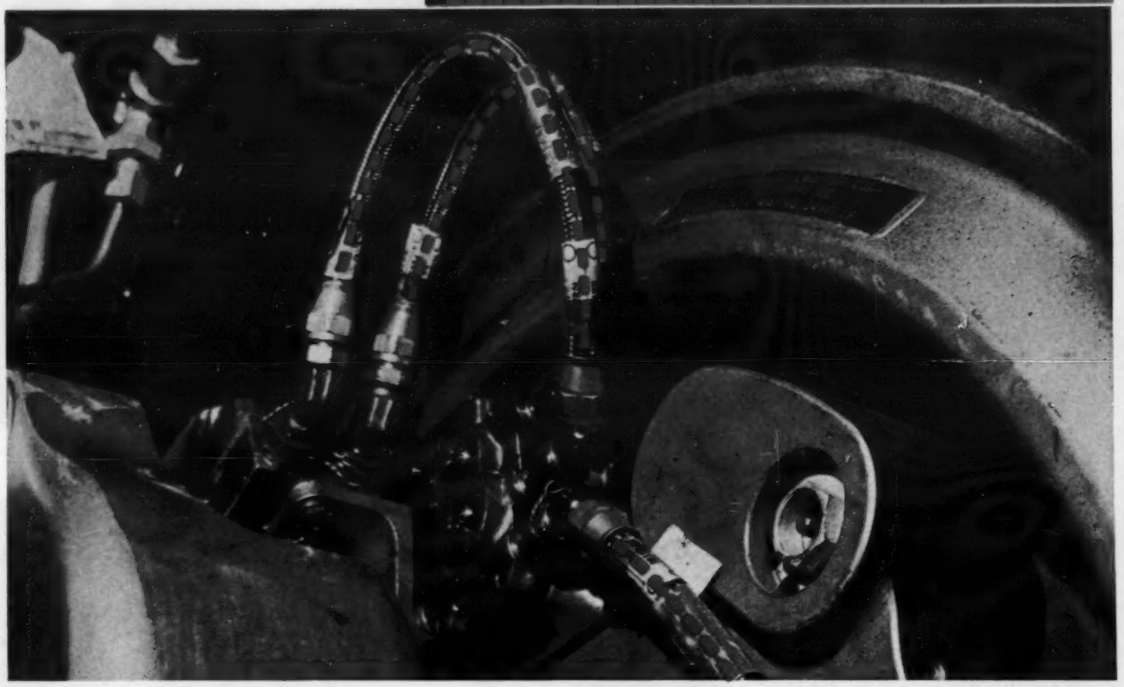
Harness-Board Wire Fastener 311



"Wiretainer" is designed to provide a firm grip on individual wires while wiring any kind of harness board. With a single motion, each wire is secured until all wires are ready for lacing. Fasteners maintain an orderly harness board, eliminate the practice of using tape, tacks or other means which can harm wires during layout. They are durable, retain their resiliency and can be used indefinitely. To fit particular needs, fasteners can be custom made in any size, gage and quantity. Standard fasteners are available in two categories: narrow gage for wires from 0.010 to 0.040 inch and broad gage to hold wires from 0.045 to 0.080 inch. Either gage is available to hold from two to 12 wires.

Holtronics, 7100 Avalon Blvd., Los Angeles 3, Calif.

DU PONT TEFLON®



Hose lined with TEFLON® solves problems of pressure, temperature, corrosion, limited space

Can You Afford Not to Use TEFLON®?

Constructions of hose lined with TEFLON are your logical and most economical choice whenever severe environmental conditions are encounted, AND whenever you want—

. . . functional reliability and greatly increased service life

. . . reduced costs of replacement, maintenance and downtime

. . . greater standardization with reduced inventories

. . . the competitive advantage of quality and dependability

If any of these considerations are important to your design, the choice of any other kind of hose might well be wasteful.

Hoses lined with Du Pont TEFLON TFE fluorocarbon resins are employed throughout a new commercial cargo plane to insure the utmost reliability under exacting service conditions. Shown above are hose lines to the hydraulic anti-skid brake system, operating at 1,750 psi and in the presence of corrosive fluids. In addition to these fluid power lines, other hoses lined with TEFLON handle oils and fuels at temperatures to 200°F. and pressures up to 3,000 psi.

In a wide variety of industrial designs, hose lined with TEFLON is providing complete resistance to virtually all chemicals encountered . . exceptional durability under continuous flexing, including torque stress and vibration . . . and making possible space savings by the use of smaller outside-diameter hose.

New constructions include fiber reinforcements, elastomeric coverings, convoluted tubing and a variety of industrial couplings. For more details, consult your hose supplier, or write to: E. I. du Pont de Nemours & Co. (Inc.), Dept. DN-522, Room 2526T, Nemours Bldg., Wilmington 98, Del. **In Canada:** Du Pont of Canada Ltd., P. O. Box 660, Montreal, Que.

DU PONT REG. U. S. PAT OFF TEFLON® FLUOROCARBON RESINS

TEFLON is Du Pont's registered trademark for its family of fluorocarbon resins, including TFE (tetrafluoroethylene) resins and FEP (fluorinated ethylene propylene) resins

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

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MECHANICAL

Angle Counter 312

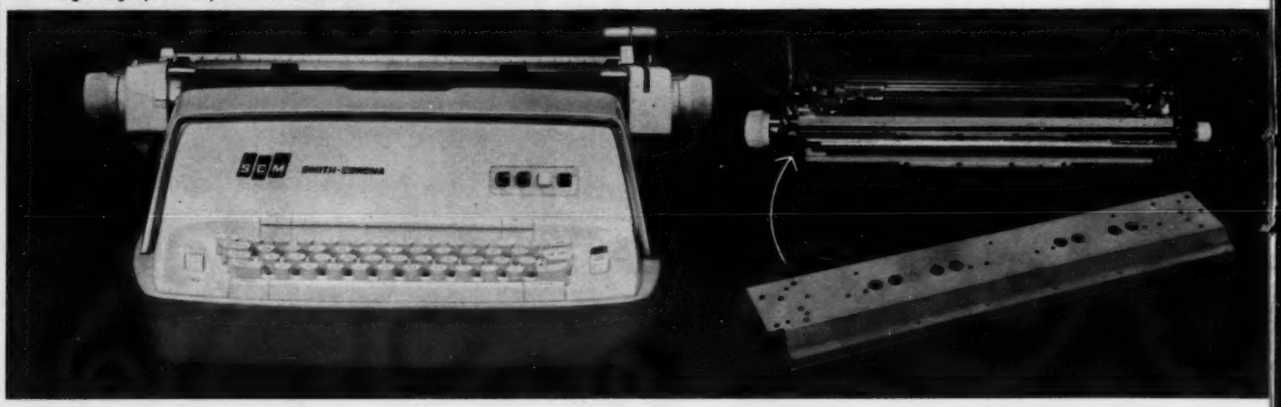
Measuring less than ¾ inch high by 1 inch deep by 1⅓ inches long, this miniaturized angle counter cuts weight by more than 50 percent under that of standard counters providing the same basic counting configuration. Model 11646 provides readings from 000.0 to 359.9 deg with characters a full ⅛ inch tall. Each numeral of the "tenths" counter wheel provides increasing or decreasing readings of 1/10 deg, but a vernier scale on the right side of wheel permits accurate reading in increments of three minutes. One revolution of input shaft provides one revolution of "tenths" wheel and 1 deg of angular change. The counter is designed for continuous operation at 200 rpm. A major advantage of this unit is the saving in weight and size under a standardized design used in the same general type of application (the manufacturer states). Viewed from corresponding perspectives with the BuOrd Mk 2 Mod O design providing the same reading information, the device is only half as high; it measures 0.4 inch less in depth and is approximately the same in length. The angle counter weighs approximately 1.12 oz.

Bowmar Instrument Corp., 8000 Bluffton Rd., Ft. Wayne, Ind.

Automotive transmission stator blade

Printer's furniture, The Challenge Machinery Company

Lightweight precision part for Smith-Corona "400"



ELIMINATE MACHINING, CUT PRODUCTION COSTS WITH MAGNESIUM PRECISION EXTRUSIONS

These close-tolerance parts were produced with no machining costs! They're Dow precision magnesium extrusions which require only end trimming or cutting to length before use . . . and where transverse holes are needed, drilling and tapping. Dow precision magnesium extrusions help manufacturers cut production costs, while providing tolerances as close as ± .001 inch on critical cross-sectional dimensions, dimensional stability and light weight. There is no machining on the typical parts above . . . component for the ultra-modern Smith-Corona "400" Office Electric Typewriter; The Challenge Machinery Company's printer's furniture; and automotive transmission stator blade. Precision magnesium extrusions can be produced with sharp V's, thin notches, and accurate serrations. Complex parts can be given a consistent precision fit. For information, write to THE DOW METAL PRODUCTS COMPANY, Midland, Michigan, Merchandising Dept. 1104AV5-22.

DOW

THE DOW METAL PRODUCTS COMPANY

Division of The Dow Chemical Company

Circle 47 on Reader-Service Card

DOW

NEW DOW MAGNESIUM ALLOY ZE10A

high welded joint strength and no stress relief!

New Dow magnesium alloy ZE10A needs no post-welding stress relief. This strong sheet alloy is ideal for fabricating containers, vehicle bodies and other structures . . . and for field repair operations where stress relief can be a real problem.

ZE10A provides very high welded joint strength, important in butt welding of plates. The result—strong, stiff weldments of very light weight . . . with greater capacity, pound-for-pound, than structures made from any other metal!

To weld ZE10A sheet to extrusions, use Dow extrusion alloy ZK21A. No stress relief required. For further information and data, write THE DOW METAL PRODUCTS COMPANY, Midland, Michigan, Merchandising Dept. 1152AV5-8.

ZE10A makes light, strong containers, like this Tote Bin, built by Tote Systems, Inc., Beatrice, Neb., a subsidiary of Hoover Ball and Bearing Company.

DOW

THE DOW METAL PRODUCTS COMPANY
Division of The Dow Chemical Company
Midland, Michigan

Circle 47 on Reader-Service Card

Swivel-Pad Clamp 313

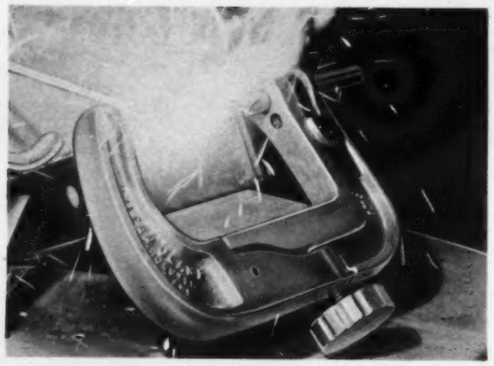
The thumbscrew "Swivel-Pad Clamp" is a combination of a holding tool, which applies a controlled end pressure, and a pad clamp, which permits a part to be securely held without marring its surface. The component is available as stand-

ard in four sizes: ¼-20 by 2½ inches; 5/16-18 by 2¼ inches; ⅜-16 by 2¼ inches, and ½-13 by 3 inches.

Vlier Engineering Corp., 8900 Santa Monica Blvd., Los Angeles 46, Calif.

Special Welding Clamps 314

Threadless-spindle seat-clamps permit mounting in any position from within ¼ inch of arc. Spindle of the clamp is made of solid beryllium copper which eliminates necessity of using special coatings and protective shields. Spatter will not stick to spindle or to body of clamp. Clamps are quick closing and opening. Spindle eliminates



frame twisting when tightened, and anvil and spindle will not turn as pressure is applied, eliminating clamp marks on materials held. Units are available with V-spindles and may be obtained in 2-, 4-, and 6-inch standard frame sizes and 4- by 4- and 6- by 6-inch-deep throat sizes. Brackets may be obtained to permit standard frame clamps to be used as bench vise.

United Associates, 1605 N. Hercules Ave., Clearwater, Fla.

put power where you want it

Flexible shafts give the designer important new freedom in transmitting rotary power or control between two points. They enable you to position your power source and your driven part to best advantage . . . without worrying about obstructions, vibration, shock or alignment.

Even if the components are in relative motion to each other, you can still transmit power smoothly and economically.

Flexible shafts also reduce manufacturing costs . . . use fewer parts . . . eliminate cumbersome gears, drives, couplings, universals. With rigid connections gone, alignment and tolerance problems fade away, and installation is a snap.

Whatever your rotary transmission problem, there is a good chance that one of S. S. White's flexible shaft lines can solve it . . . *Standard, Pre-Engineered,* or *Custom-Designed* flexible shafts.

S. S. WHITE INDUSTRIAL DIVISION,
DEPT. D 10 East 40th Street, N. Y. 17, N. Y.

BOOTH 916 DESIGN ENGINEERING SHOW

THE S. S. WHITE FLEXIBLE SHAFT HANDBOOK
New 4th Edition . . . Send for your free copy!

1150

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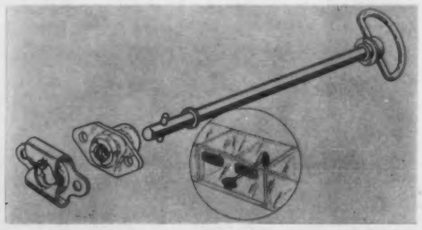
Module Fastener 315



Easy engagement and disengagement of module to rack and positive lock of multiple-pin connectors are features of a new rapid-traverse fastener. Assembly is composed of a variable-length stud shank, a nylon guide bushing and a standard, military-approved, quarter-turn receptacle. When cross-pin on stud shank travels 1¼ turns through guide bushing, a steady, even pressure is exerted laterally across connector. An extra quarter turn locks cross-pin in receptacle. Fastener is offered with wing, swivel-ring, knob or screwdriver slot stud head.

Monadnock Mills, Subsidiary of United-Carr Fastener Corp., San Leandro, Calif.

Actuator Motor 316

A 1-inch-dia motor, complete with gear train, measures 2½ inches in length and weighs only 4 oz. The unit is designed to operate up to 1000 hr without maintenance and meets requirements of MIL-M-8609 (ASG) for humidity, vibration, salt spray and other environmental conditions. Gear reductions and armature windings can be varied to provide specific torques and speeds. This compact motor operates over an ambient temperature range of —65 to 250F, from an input voltage of 24-29v d-c. Speed is 270-280 rpm, with normal rated load of 13 oz-in

Omega Precision, Inc., Electro-Actuators Div., 757 N. Coney Ave., Azusa, Calif.

Circle 49 on Reader-Service Card

SYLVANIA SHAVES COSTS FOR SCHICK-IN PLASTICS, METALS AND ASSEMBLIES

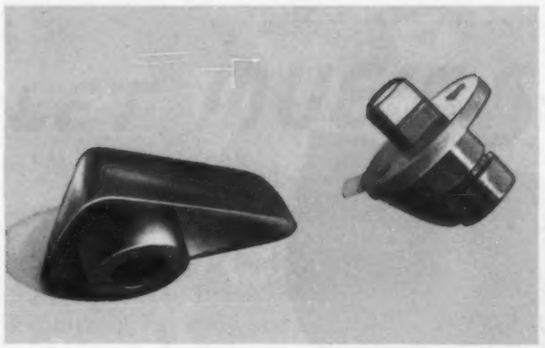
Producing the switch for a compact, 3-speed electric razor leaves almost no margin for error. It must be precisely built and still withstand the punishing abuse of day-to-day handling.

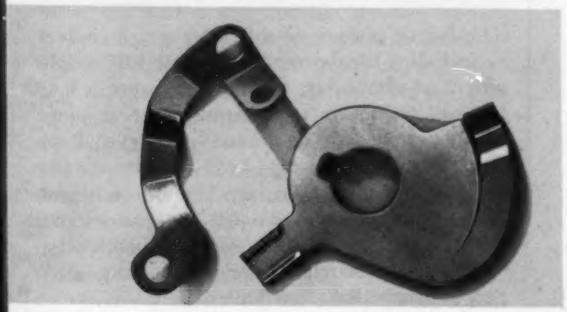
In making the switch for the new Schick razor shown below, Sylvania Parts Division meets these requirements. Our experience with a wide range of materials resulted in better electrical contacts. And our facilities assure durable, precision parts and assemblies as well as high-speed production. The combination means important economies to Schick.

For details, see captions at the right. For full information on how Sylvania custom parts facilities can benefit *you*, or for a quote on a specific project you have in mind, write Sylvania Electric Products Inc., Parts Division, Warren, Pennsylvania.

MOLDED FROM PLASTIC are parts for the switch assembly. Each must meet the tightest specifications. Example: Sylvania molds shaft and selector button from nylon, holds dimensions on both to a height and diameter of ±.0015". In addition, the flash is controlled to 1/32" because the button is a snap fit on the shaft. Since Sylvania maintains one of the world's most modern and complete lines of automatic molding equipment, it can handle volume orders for compression, injection and transfer molding. And a unique bank of rotary presses can produce millions of precision parts each day—even using phenolics and urea.

Result to Schick? Precisely molded parts—in volume!



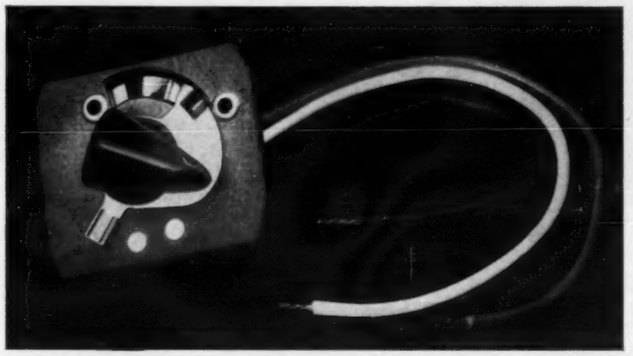


CUSTOM METAL STAMPINGS also proved important to Schick. Sylvania recommended changing the selector detent and rotor to brass, thus permitting a reduction in thickness from .015" to .010" and assuring an improvement in contact from rotor arm to detent. Sylvania made the dies necessary to produce these parts. The Sylvania metal stamping facility includes multi-slide machines, vertical presses and specially developed machines to help solve your problems.

Result to Schick? Positive electrical contacts assured while a 5° offset on the selector rotor is maintained to within ±1° day in and day out.

CUSTOM ASSEMBLY by Sylvania of the switch assembly is handled by our corps of trained specialists. Many of our customers have found that Sylvania can often deliver completely assembled and packaged products—using either all Sylvania components or a combination of some Sylvania and some customer supplied—*at lower cost than is possible in the customer's own facilities.*

Result to Schick? Thousands of completed, durable and precision assemblies per month.



NEED CUSTOM WELDING OR WIRE? Sylvania supplies both. To help you meet your welding needs, Sylvania has developed new high-speed, high-volume techniques and advanced welding equipment—automatic and semiautomatic. To help you with wire, only Sylvania of all major manufacturers makes all three types of bare wire—alloy, clad and plated. They're available in a full range of sizes, too—.002" to .250". Where necessary, Sylvania will precision-roll wire into ribbon connectors that offer high reliability when the circuitry calls for wire wrap contact methods.

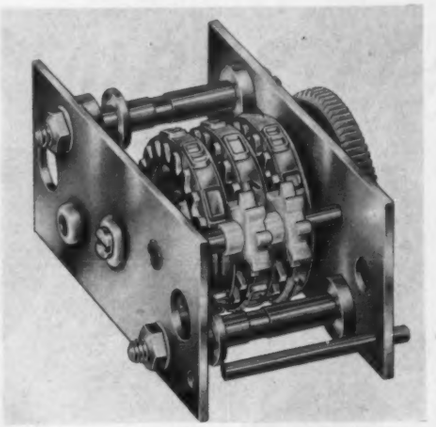
SYLVANIA

SUBSIDIARY OF

GENERAL TELEPHONE & ELECTRONICS

GENERAL SYSTEM

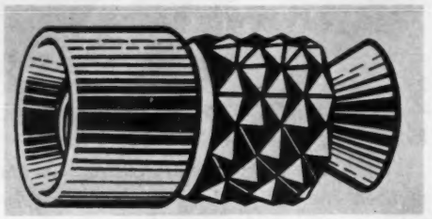
Printing Counter 317



This basic counter has three digits but additional digits or decimal points may be incorporated as needed to suit customer design requirements. Available with the counter are an automatic indexing mechanism, printing ribbon drives and a printing solenoid. The unit features a printing speed up to 5000 counts per minute and low starting torque of 0.05 oz-in. Standard character height is 3/16 inch with a spacing of 9/32 inch.

Radson Engineering Corp., Macon, Ill.

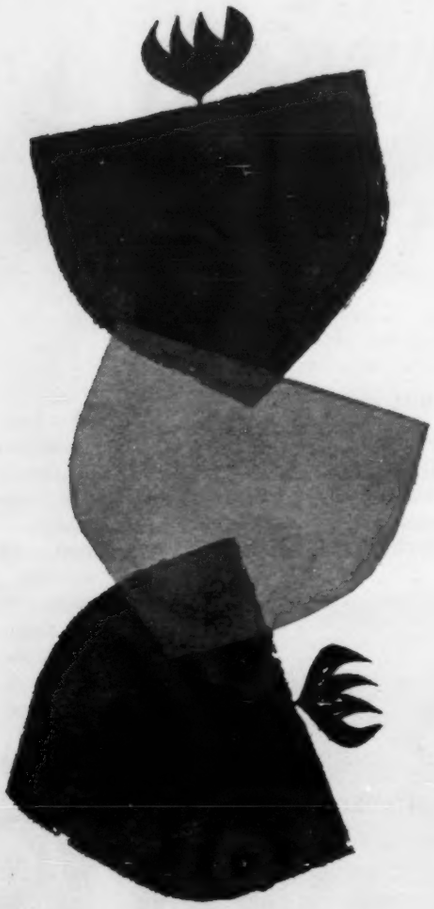
Threaded Insert 318



Expansion inserts—which provide durable brass threads in molded plastic—include miniature inserts for screw sizes 0-80 through 3-48. Installing the insert after molding reduces open press time and obviates the secondary operation of flash removal. Fastening component is a one-piece brass insert that works equally well in molded or drilled holes in plastic components. As downward pressure is exerted on top of insert, cone section at base breaks free and is forced up into main portion of insert. The insert provides substantial strength when properly installed. For example, a No. 2-56 cone-spread insert will resist an average 110-lb pullout strength and will not loosen even under applied torque of up to 8 lb-in.

Phelps Mfg. Div. of Heli-Coil Corp., Danbury, Conn.

Circle 49 on Reader-Service Card



Said Isaac Newton:

"Every particle of matter attracts every other particle with a force directly proportional to the product of their masses and inversely proportional to the square of the distances between them."

Until recently, the thrust which propelled rocket vehicles into their coast stage, prior to orbiting, was provided by booster stages. The fuel carried by the satellite stage was used only to inject itself into orbit.

Now, however, a scientist at Lockheed Missiles and Space Division has evolved a Dual Burning Propulsion System which allows higher orbits and heavier payloads. With this system, the satellite vehicle fires immediately after the last booster stage burns out, thus augmenting the begin-coast speed. Later the satellite stage is re-started to provide orbit injection.

An even more recent development by Lockheed is a triple-burning satellite stage. This will permit a precise 24-hour equatorial orbit, even though the vehicle is launched a considerable distance from the equator.

These principles have made possible the early development of the MIDAS satellite. Moreover, they substantially increase the altitude and payload of the DISCOVERER series. Lockheed, Systems Manager for these programs and for the POLARIS FBM, is pursuing even more advanced research and development projects. As a result, there are ever-widening opportunities for creative engineers and scientists in their chosen fields.

Why not investigate future possibilities at Lockheed? Write Research and Development Staff, Dept. M-15C, 962 West El Camino Real, Sunnyvale, Calif. U.S. citizenship or existing Department of Defense industrial security clearance required.

All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

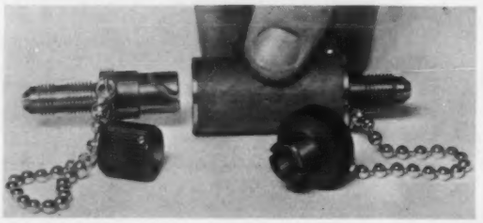
Lockheed / MISSILES AND SPACE DIVISION

Systems Manager for the Navy POLARIS FBM and the Air Force AGENA Satellite in the DISCOVERER and MIDAS Programs

SUNNYVALE, PALO ALTO, VAN NUYS, SANTA CRUZ, SANTA MARIA, CALIFORNIA • CAPE CANAVERAL, FLORIDA • HAWAII

MECHANICAL

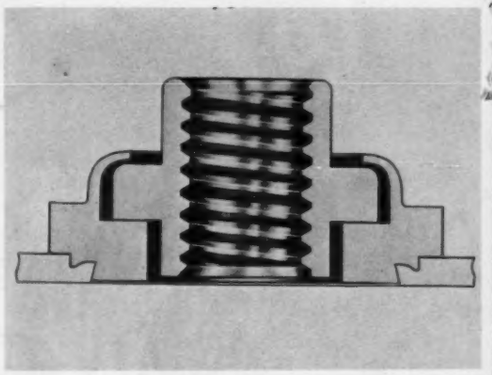
Miniaturized Filler Valve 319



The female portion of this valve weighs only 4 oz including dust cover, while male half weighs only 2 oz with cover. Operating pressure is 0 to 200 psi. Operating temperature covers a range of —420 to 260F. The ground (female) half incorporates an insulating sleeve and an annular air space as a thermal barrier. Useful for cryogenic, pneumatic and hydraulic applications, the valve can be supplied in a range of fittings.

Airborne Research & Development Corp., 7530 San Fernando Rd., Sun Valley, Calif.

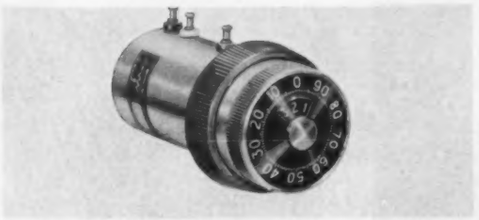
Self-Clinching Fastener 320



Clinched by a squeeze into prepared holes, this fastener provides a rapidly assembled nut anchor in sheet metal and compensates for slight errors (up to 1/32 inch) in alignment of mating holes. Sizes No. 4 to ¼ inch are suitable for sheet thicknesses from 0.040 inch up and materials with Rockwell hardness of B-70 or less. Threads are class 3B. Performance meets MIL-N-25,027. Type LAS has cadmium or cadmium-chromate-finished steel retainer with nut of 18-8 stainless steel, passivated and with dry-film lubricant. Type LAC is stainless steel throughout, passivated and with dry-film lubricant.

Penn Engineering & Mfg. Corp., Doylestown, Pa.

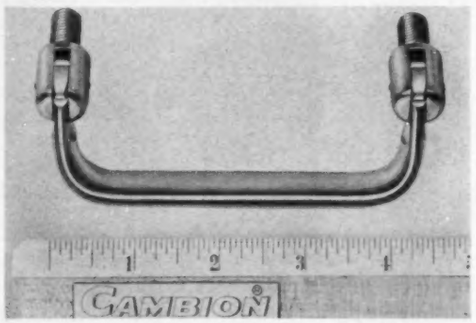
Turns-Counting Dial 321



Only 1 inch in dia or 1-5/32 inches with addition of a fingertip brake, the "Microdial" projects from a panel only 15/16 inch and can be grouped as closely as 1¼-inch centers. Listed as Series 3000, this dial is designed for accurate angular positioning of any precision potentiometer or shaft-controlled device of 10 turns or less. Standard models accommodate shafts of either ⅛ or ¼ inch. Special shaft size accommodations are obtainable on special order. The designer has a choice of five brake-knob colors and three combinations of numeral and background colors. Models with fluorescent numerals also are offered. The aluminum control knobs can be color-anodized on special order.

Amphenol-Borg Electronics Corp., Borg Equipment Div., 120 S. Main St., Janesville, Wis.

Folding Panel Handles 322



Two oval folding handles have been added to an extensive line of cabinet hardware. No. 2721 is a three-position handle which folds a full 180 deg against panel. A two-position handle, No. 2722, folds 90 deg against the panel. Positive-locking device in both handles assures firm position grip. Handles are 4 inches in length and maximum depth of handle from panel is 1.797 inches. Both units are of quality brass with lasting finish of buffed and polished nickel plate or black oxide. Other standard handles are offered in sizes up to 9 inches long and 1¾ inches high.

Cambridge Thermionic Corp., 45 Concord Ave., Cambridge 38, Mass.

LET MUELLER MAKE IT!

Mueller Brass Co. of Port Huron is much more diversified than the name "Brass" implies . . . a lot more. In fact, because of its many and varied facilities . . . its *men, methods* and *metals* . . . Mueller is in the unique position of being able to offer true single source service.

MUELLER HAS THE MEN . . . experienced engineers with the ability to work out, creatively, tough design problems, and improve a part or components for production by the most economical method. You get sound engineering plus 44 years of practical metalworking production experience when you "Let Mueller Make It".

MUELLER HAS THE METHODS . . . when you "Let Mueller Make It", you are utilizing one single source that is able to produce parts any one of these ways: as forgings, impact extrusions, sintered metal parts, screw machine products, formed tube or as castings.

MUELLER HAS THE METALS . . . and the materials . . . to produce precision parts in aluminum, brass, bronze, copper, iron and steel in hundreds of different alloys to meet each exact requirement.

In addition, Mueller Brass Co. has complete and modern facilities for performing all types of finishing and sub-assembly operations. Another plus value is nation-wide sales engineering service.

So, in the final analysis, no matter where you fit in the American industrial picture, whether you're making missiles or mowers . . . and no matter where you're located, it will pay you to LET MUELLER MAKE IT!

MUELLER BRASS CO. PORT HURON 23, MICHIGAN

See Us At Booth 701—Design Engineering Show—Cobo Hall, Detroit, May 22-25

345

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YOU CAN ADD THIS ENGINEERING TEAM TO YOUR STAFF WHEN YOU

LET MUELLER MAKE IT!

When you work with the Mueller organization, a qualified team of trained, experienced and imaginative engineers automatically become part of your staff and go to work for you. This engineering team, which includes specialists in all categories of design work and production procedures, carefully considers all aspects of your particular part or assembly and its function. In conjunction with members of your engineering department, Mueller engineers can help design or re-design your part for improved performance, eliminate, where possible, unnecessary parts through re-design by making two or three part assemblies as a single piece, and recommend the best method of production. Mueller people also consider ways of speeding your finishing and assembly operations. Production economies consistent with product quality are always a prime consideration.

This TOTAL CONCEPT engineering service, which costs no more, is available to you when you . . . LET MUELLER MAKE IT!

MUELLER BRASS CO. PORT HURON 23, MICHIGAN

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38

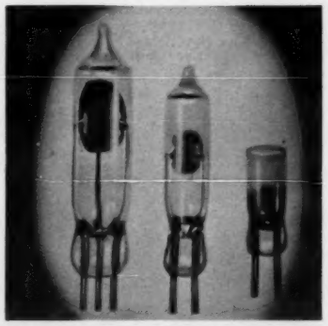
ELECTRICAL

Relays 323

Available in 2-, 3- or 4-pole double-throw forms, "Nyline" relays may be equipped with coils for a-c operation to 230v maximum and d-c to 115v maximum. The 4-pole relay measures only 2⅝ by 3⅛ by 1-29/32 inches. Relay contacts, rated at 10 amps, are self-aligning and self-cleaning.

Ward Leonard Electric Co., Mt. Vernon, N. Y.

Photocells 324

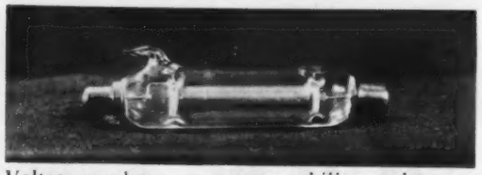


Subminiature, all-glass, hermetically sealed cells are environmentally stable with pins for socket mount or flexible leads. They are now being used or are adaptable for use in such equipment as electronic computers, sound projectors, temperature-measuring devices, infrared communications apparatus, missile guidance systems, fire detectors and solar temperature computers. The line of cells includes a broad range of sizes, broken down into several sensitivity ratings.

Cetron Electronic Corp., 715 Hamilton St., Geneva, Ill.

Circle 51 on Reader-Service Card

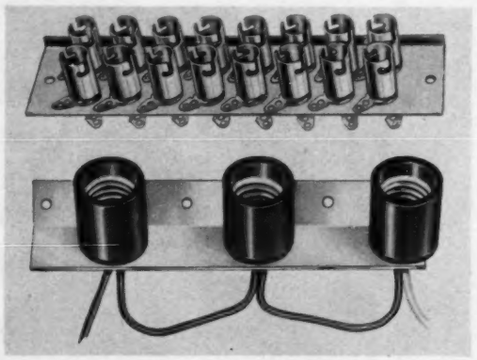
Low-Cost HV Regulators 325



Voltage-regulator or corona-stabilizer tubes are now being manufactured at low cost. Model Type CS 3 is a low-current gas discharge for supply circuits and is suitable for counter tubes, photomultipliers, stabilizing beam focusing and accelerating potentials of cathode-ray devices. It also may be used as a general-purpose voltage-reference tube for all electronic equipment. Voltages from 400 to 2000v are available in long-term stability of 0.5 percent and temperature stability of better than 0.01 percent per deg C. Voltage tolerance is ±2½ percent on stock items. Length is 3.34 inches and diameter is 0.66 inch.

Connolly & Co., P. O. Box 295, Menlo Park, Calif.

Multiple-Lamp Sockets 326



For applications that require multiple arrangements of lamp sockets, a complete assembly can be furnished with sockets spaced and wired to specifications. The sockets can be mounted on strips or plates, grounded or insulated, with soldering terminals or wire leads. Mounting brackets can be obtained in a variety of materials and finishes—including steel, brass, aluminum and phenolic. A complete range of miniature lamp bases is represented, such as miniature-screw, miniature-bayonet, candelabra-screw, candelabra-bayonet and intermediate-screw. All sizes, types and lengths of wire leads are offered, terminated with the most widely used solderless connectors. Prototype samples can be supplied against a submitted sketch or drawing.

Leecraft Mfg. Co., Inc., 58 Greene St., New York 12, N. Y.

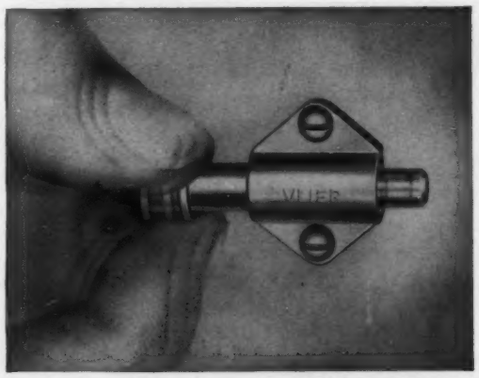
Practical Design Tips

No. 4 of a series

Hundreds of companies are now saving by using off-the-shelf Vlier products like the ones shown below. These simple, low cost, precision parts save designers time and, in many cases, simplify product design and manufacture. Why not investigate their possibilities today.

BALL PLUNGERS WORK BETTER than spring plungers when side loads are involved. Balls won't bind from side thrusts, retract easily. Available in 10 standard sizes from 4-48x3/16" to 5/8-11x1". Various end pressures. Special sizes and end pressures made to quantity orders.

TORQUE-LIMITING WRENCH for assembling small parts, adjusting set screws, etc., is easily made from a Vlier Torque Handle and a length of hexagon stock. Prevents over-tightening, and subsequent damage to parts. End pressure is adjustable from 15 to 200 lbs.



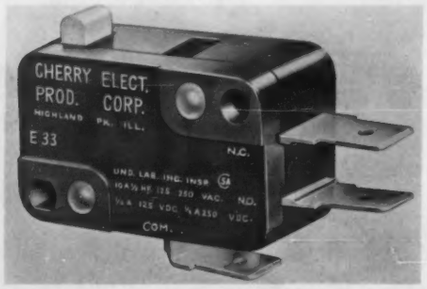
NEED A SMALL, LIGHTWEIGHT, SPRING-LOADED LATCH? One enterprising designer modified a standard Vlier S-88 Spring Stop that did the job perfectly. Entire latch weighs less than 1/3 oz. Body is die-cast aluminum; plunger is heat-treated alloy steel. Various plunger pressures. Available on quantity orders only.

FREE IDEA BOOKLET. Illustrations in this 16-page booklet show how others have profited from the use of Vlier products. Illustrates both the usual and unusual applications. May suggest ways *you* can save. Write for your copy today.

VLIER
Engineering Corporation
A subsidiary of Barry-Wright Corporation
8900 Santa Monica Blvd. • Los Angeles 46, California

Circle 52 on Reader-Service Card for more information

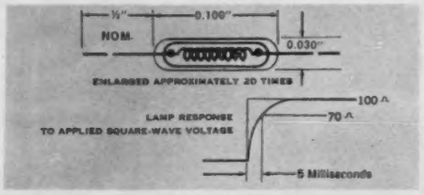
Low-Cost Switch 327



Simplified coil spring construction provides long mechanical and electrical life, with 0.050-inch minimum overtravel, in the E33-OOA series snap-action switch. The unit features standard mounting dimensions, terminal variations of screw, quick-connect or solder lug, and case-molded, hinged-pivot roller and roller-leaf actuators. The flat switch case, 1-3/32 by 5/8 by 13/32 inch, permits individual or gang-assembly use for multiple-cam operation. Electrical rating is 10 amps, ½ hp, 125/250v a-c.

Cherry Electrical Products Corp., 1650 Deerfield Rd., Highland Park, Ill.

Microminiature Lamp 328



The development of two microminiature incandescent lamps has made possible a broad choice of physical and electrical characteristics. "Pinlite Type 13-7" permits battery operation for extended periods of time plus fast response to pulsing at audio frequencies. The component fulfills this requirement by consuming only 0.009w at 1.35v. Lamp response to pulsing at half brightness is better than 4 millisec. Type 30-30 answers the demand for a lamp of microminiature proportions capable of high light output by providing approximately 250 millilumens at 3v. Since this lamp is slightly larger than Type 13-7, it offers the advantage of lower cost.

Kay Electric Co., 14 Maple Ave., Pine Brook, N. J.

Another finishing first from Amchem!

ALODINE* Chemicals for Spray-Dip Processing Costs in Half Through and Handling at Crown Aluminum!

Crown aluminum siding features beauty, durability and convenience . . . a wide selection of color harmonized paints, year-in, year-out product performance and virtually no maintenance. Amchem Alodine plays a key role in providing the paint system with its outstanding wearing qualities.

Pre-Paint Finishing Slashes Reduced Maintenance, Downtime

Mr. LOUIS HIRSCH, dynamic Crown President says—

"THE INDUSTRY'S FIRST ORIGINAL DESIGN SPRAY-DIP SYSTEM HAS LOWERED THE COST OF SIDING PROCESSING WHILE MAINTAINING HIGH QUALITY AND UNIFORMITY"

Inspired and designed by Amchem in conjunction with Crown engineers and quality control personnel, *the industry's first spray-dip, pre-paint system designed from the ground up,* is providing Crown Aluminum—one of the nation's top three siding producers, with unprecedented savings in processing costs, time and labor.

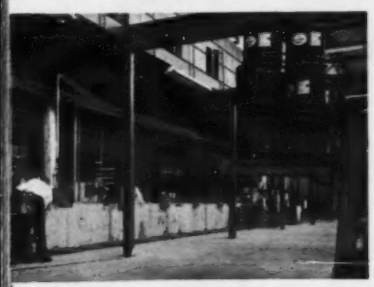
On several million square feet of aluminum strip treated to date, Crown can point to a 50 percent reduction in overall processing costs through virtual elimination of costly maintenance and downtime. With the addition of this new line, siding production capacity has doubled.

In side-by-side comparisons with an existing all-spray system at Crown's Roxboro (N. C.) plant, the new spray-dip combination has demonstrated outstanding superiority over straight spray—the result of eliminating complicated, time-consuming periodic maintenance associated with spray chamber operation.

Under all of Crown's exacting test standards—salt spray, humidity, infra-red—Alodine quality has remained constant. The proof—not a single paint failure complaint from the field since production started!

If you're considering installation of pre-finishing equipment, or refurbishing your present system—don't make a move till you've investigated Amchem Alodine and spray-dip for coated coil processing. Your nearest Amchem Representative is ready to supply facts and figures on system requirements at your convenience.

* Amchem's registered trademark for its conversion coating chemicals for aluminum.



Crown 5-stage Amchem spray-dip line located on mezzanine level of plant. Overall length of finishing and paint line is 291'6".

Amchem electronic sensing device on stage one cleaner provides automated feed of chemicals.

Amchem Technical Representative conferring with Crown Production Supt. George Hagler (left) on final adjustments to new paint line.

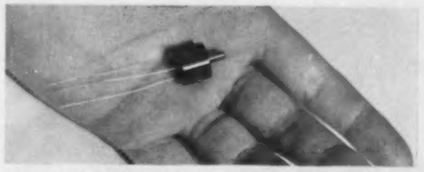
AMCHEM **ALODINE**

Amchem is a registered trademark of
AMCHEM PRODUCTS, INC. (Formerly American Chemical Paint Co.)
AMBLER, PA. • St. Joseph, Mo. • Detroit, Mich. • Niles, Calif. • Windsor, Ont.

Write for Bulletin 1424C, gives detailed technical specifications on different Alodine chemicals available for pre-treating aluminum.

Circle 53 on Reader-Service Card for more information

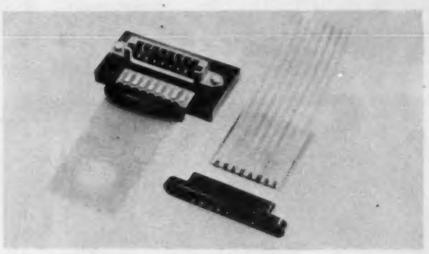
Miniature Trimmer 329



A ½-inch trimmer potentiometer features an infinite-resolution, conductive-film element, allowing user to set extremely small adjustments. The device is available in a range of resistances from as low as 100 ohms to as high as 100K ohms, ±20 percent. This miniaturized component has a high starting torque of 7.5 oz-in, assuring the user that it will not shift position under shock and vibration. Basic specifications include: mechanical rotation, continuous; electrical function angle, 300 deg, ±10 deg; linearity, 3 percent; wattage, 0.25w, and temperature range, —55 to 150C.

Computer Instruments Corp., 92 Madison Ave., Hempstead, Long Island, N. Y.

Connectors 330

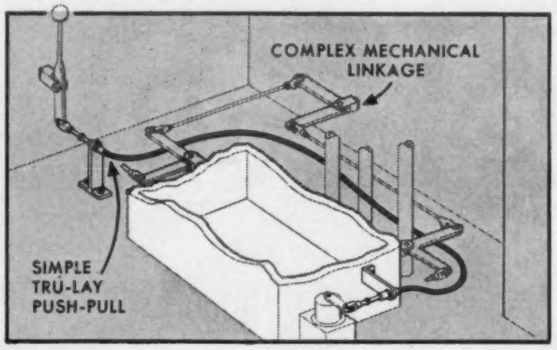


High-reliability, printed-circuit connectors have female contacts similar to miniaturized fuse clips. In independent tests, connectors sustained prolonged vibration of more than 40 G from 5 to 2000 cps without circuit discontinuity. Positive pressure and moisture seals are provided. Design temperature is —60 to 450F. Male "Fuz-Lok" contacts with 0.156-inch spacing are staked to printed-circuit boards or tape cable without soldering, eliminating rhodium-plated insertion tips or pads on boards, and allowing substantial reduction in board area. Single- and double-sided (and ended) connectors provide circuit combinations for boards, tape and wiring for 5 to 86 contacts.

Matrix Science Corp., 3311 Winona Ave., Burbank, Calif.

TRU-LAY *PUSH*-PULL CONTROLS PROVIDE ACCURATE, DEPENDABLE REMOTE CONTROL FOR HUNDREDS OF PRODUCTS

• If your products involve remote control—electrical, hydraulic, pneumatic or direct—TRU-LAY PUSH-PULL FLEXIBLE CONTROLS can help solve your design problems. They provide positive remote control over long or short distances—up to 150 feet from the control point. Because they operate while flexing, they can snake around obstructions. They will not buckle. They are ruggedly constructed, easily installed and operated, sealed against dirt and moisture, and will handle jobs with as much as 1,000 lbs. input. PUSH-PULL CONTROLS are simple, have but one moving part, are noiseless, and give a lifetime of accuracy. Mechanical linkages, on the other hand, are complex. Unlike PUSH-PULL CONTROLS, they are made of many parts, wear at many points, and produce increased backlash, lost accuracy, and vibration rattles.



Sizes and Operating Heads to Fit Your Design

Control Dimension	Minimum Recommended Radius in Inches	Maximum Input Load in Pounds (Dependent on Travel)
3/32"	2	30
1/8"	3	65-125
3/16"	5	115-175
1/4"	6	300-600
5/16"	8	700-1,000

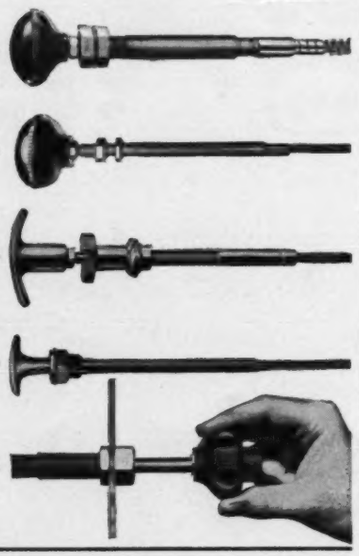
Heavy Duty • For use where rugged duty prevails, but where operation must be smooth and accurate. Meets all requirements for dependability and life.

Light Duty • Gives smooth, accurate and dependable performance at low cost. Available with your choice of several types of knobs.

Selective Friction • Amount of friction can be changed to meet individual requirements of the operator or application. Friction constant at any setting.

Position Lock • A slight turn of the T-type handle locks the control in any position. Available in two sizes for light and heavy-duty applications.

Micro Control • Push or pull the knob for instantaneous response, then rotate knob for vernier adjustment. Built for smooth, efficient operation on any job.



PUSH-PULL DATA FILE shows how to simplify, improve design

PUSH-PULL CONTROLS are solid as a rod and flexible as a wire rope. They're factory-lubricated for life, unaffected by temperature extremes, and can be adapted to practically any application. For complete details on how you can use them, write for the PUSH-PULL DATA FILE. It contains 7 engineering Bulletins which describe in detail the operation of PUSH-PULL CONTROLS, their applications, features and advantages. Our engineers will be glad to help you make TRU-LAY PUSH-PULL CONTROLS a part of your product.

PUSH-PULL CONTROLS

Automotive and Aircraft Division • American Chain & Cable Company, Inc.

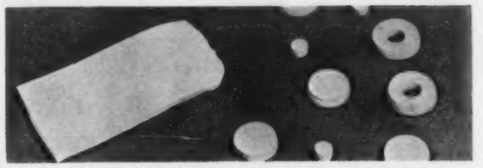
601 B Stephenson Bldg., Detroit 2

6800-B East Acco Street, Los Angeles 22 • 929-B Connecticut Ave., Bridgeport 2, Conn.

Circle 54 on Reader-Service Card for more information

MATERIALS

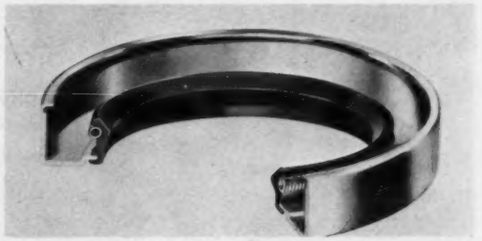
Elastomeric Sponge 331



A new engineering material offers good resistance to chemicals, acids and fuels, and has high dielectric strength and a broad temperature range. Molded from "Fluorel" 2141 elastomer, this sponge compares in hardness to a very soft rubber with about a 20-durometer (Shore A) rating, yet retains the inert characteristics of 2141 elastomer. Possible areas of application for the new material include gaskets, seals and plugs for applications which require resistance to grease, oil and commercial gasoline. Other areas of application are gaskets and seals in the presence of perchloroethylene, commonly associated with degreasing or drycleaning operations, and vibration dampening in critical applications for the missile and rocket industries.

Industrial Electronic Rubber Co., Solon, Ohio.

Shaft Oil Seal 332



A standard-design shaft-type oil seal that will satisfy the large majority of industrial, automotive, off-the-road and farm-equipment applications is now available. Designated as the CRS seal, it features significant improvements to users both in the basic seal design and in the sealing member compound used in the seal. There are no internal parts to misalign and no avenues for internal leakage. A synthetic-rubber compound specified as "Sirvene 417102", a Buna-N-based material, is said to be distinctly superior in sealing and wear-resistance properties. The seal is offered in four standard configurations: CRS, CRS-A, CRSH and CRSH-A.

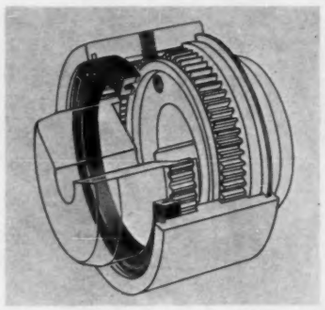
Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago 22, Ill.

Adhesive 333

"Melbond CA-100" is a ready-to-use material for ceramic dielectrics and possesses a maximum service temperature of 2600F. The material has high electrical properties, attains a high degree of mechanical strength and will not flake or disintegrate during use. It adheres well to "Melfoam", dense alumina, pyrophyilite, K-30 brick, "Foamsil" and graphite at temperatures to 2000F, to dense zirconia to 1500F and to Alundum Firebrick and cinder block up to 1000F.

Melpar, Inc., Special Products Div., 3000 Arlington Blvd., Falls Church, Va.

Gear-Coupling Seal 334



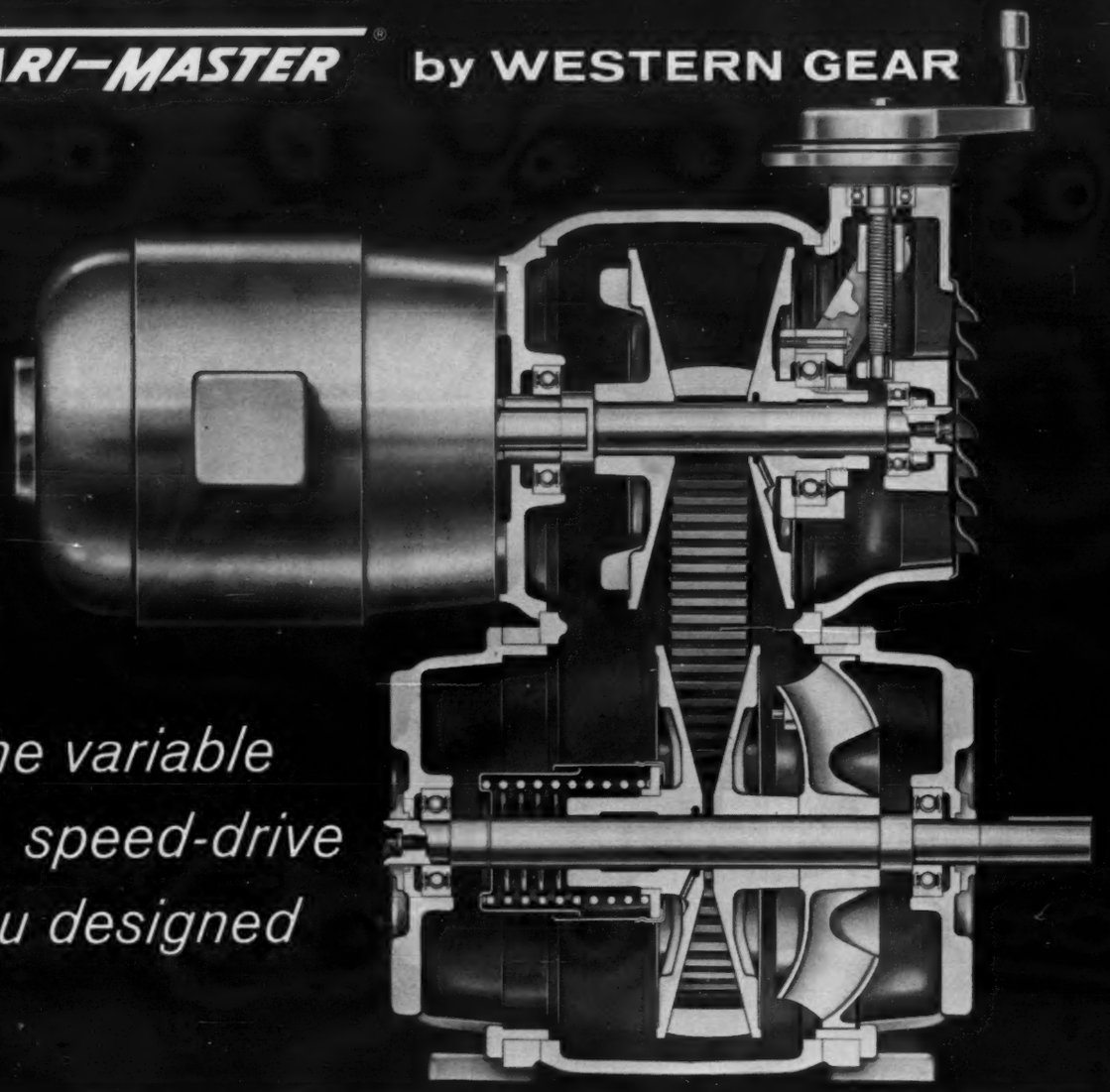
A new lubrication seal is available for a complete line of flexible gear couplings. In the seal, two separate heat-treated washers are bonded together—one inside the other—by means of a flexible hinge of Buna-N. Inner washer provides a press fit on coupling hub and outer washer has an equally snug fit in seal cavity cut into coupling sleeve. Regardless of relative motion of hub in the sleeve, flexible neoprene hinge permits washers to maintain their individual press fit and seal in lubrication at 1½-deg misalignment at operating speeds in excess of 5000 rpm.

Sier-Bath Gear & Pump Co., Inc., Flexible Coupling Div., 9250 Hudson Blvd., North Bergen, N. J.

Circle 55 on Reader-Service Card

YOU ASKED FOR IT!

VARI-MASTER® by WESTERN GEAR



the variable speed-drive you designed

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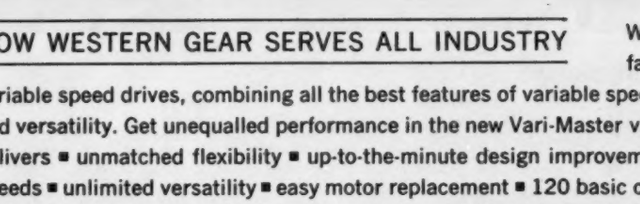
HOW WESTERN GEAR SERVES ALL INDUSTRY

Western Gear has designed, engineered and manufactured to customer requirements, the ultimate in variable speed drives, combining all the best features of variable speed drives, plus Western Gear's own built-in reliability and versatility. Get unequalled performance in the new Vari-Master variable speed drive. You asked for, and Vari-Master delivers ■ unmatched flexibility ■ up-to-the-minute design improvements ■ utmost compactness ■ infinitely adjustable speeds ■ unlimited versatility ■ easy motor replacement ■ 120 basic configurations ■ superb quality. *On the long run . . .* **QUALITY COSTS YOU LESS!** For full details, write **Western Gear Corporation,** Industrial Products Division, P.O. Box 126, Belmont, Calif., for Vari-Master Bulletin 6107F or ask your Western Gear salesman to deliver the 120-page Bulletin 6107.

OTHER TYPICAL VARI-MASTER ASSEMBLIES



WESTERN GEAR CORPORATION

WG INDUSTRIAL PRODUCTS DIVISION

'Mylar' Film 335

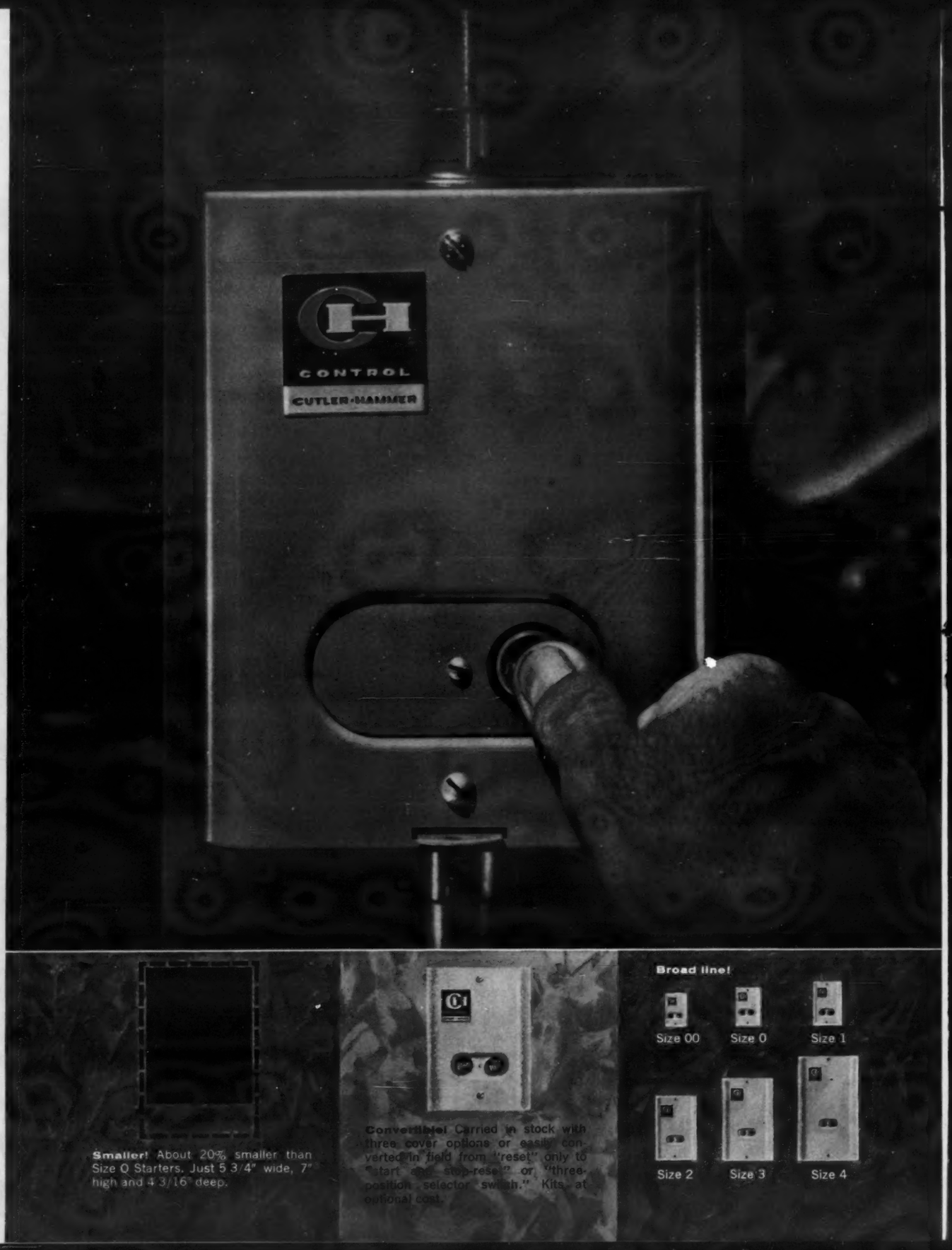
This drafting aid has an easy-on-the-eyes blue tint and increases productive drawing time of the draftsman. Identified as "Stascale", this film eliminates need for using special pencils. Drafting surface of the material takes regular india ink, allowing draftsman to use a regular drawing pen. Material lies flat on board and erases without leaving "ghosts". It resists tearing, cracking and abrasion—will not chip, crack, peel or wrinkle. It reinks without feathering. Film is also available in white.

B. K. Elliott Co., 536 Penn Ave., Pittsburgh, Pa.

Shims 336

Titanium can be applied successfully to the manufacture of laminated shims. Laminated titanium denotes an important advancement in both design and production engineering practices of today. Much in the manner of manufacturing laminated shims of stainless steel, 0.003-inch laminations of pure titanium are plastic-bonded to each other and, if desired, to a thicker sheet of titanium alloy. The manufacturer states that laminated shims of titanium not only will fulfill weight-saving and high-tensile-strength requirements for spacecraft component assemblies, but have the same peelability advantages for attaining precision fits as laminated shims of stainless steel.

Laminated Shim Co., Inc., Glenbrook, Conn.


CONTROL
CUTLER-HAMMER
Smaller! About 20% smaller than Size 0 Starters. Just 5 3/4" wide, 7" high and 4 3/16" deep.
Convertible! Carried in stock with three cover options or easily converted in field from "reset" only to "start and stop-reset" or "three-position selector switch." Kits, at optional cost.
Broad line!
Size 00
Size 0
Size 1
Size 2
Size 3
Size 4

CONTROL

A new addition to the famous three star line

New! Save space and money with Cutler-Hammer's Size 00 A-C Magnetic Starter

Takes up to 20% less space... costs 18% less than Size 0 Starters. Now you get two big new bonuses in control selection . . . less space and less money Both with the all new Size 00 Starter.

Before, you had to use a larger starter in applications where it really wasn't needed. But, now you can use the Size 00 in about 40% of the applications where the Size 0 is usually used.

The new Cutler-Hammer Size 00 Starter performs to the same high standards you get from all Cutler-Hammer Starters. And, you still get vertical, dust-free contacts which add so much to more reliable starter performance. Your choice too, of 2-coil or 3-coil overload protection in the same small enclosure.

The Bulletin 9586 Size 00 Starter can be used on any general application. Its maximum horsepower ratings: Three phase: 208/220 volts, 1½ hp. 440/550 volts, 2 hp. Single phase: 115 volts, ⅓ hp. 230 volts, 1 hp. It's available open or in NEMA 1 enclosure. Send for Pub. LO-40-J272

Why you get more from Cutler-Hammer. New things are happening at Cutler-Hammer—new, better products, new engineering ideas and talent, new plant capacity. We're on the move. And, we'd like to show you how we could help you in any electrical control problem. Contact the nearest Cutler-Hammer distributor.

WHAT'S NEW? ASK...

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler Hammer International, C. A. Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A

CONTROL

Circle 56 on Reader-Service Card for more information

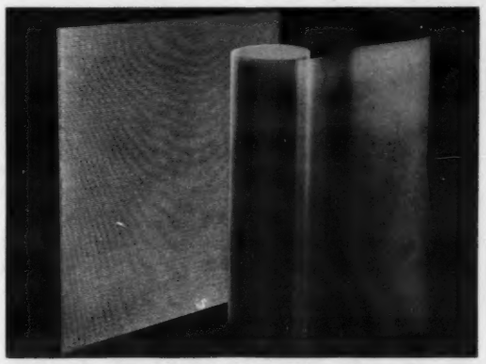
Pressure-Sensitive Tape 337

This polyethylene tape is recommended for taping jobs of all kinds, including freezer packaging, household repair and protection, closure and sealing of plastic covers and liners, drums, bags and tarpaulins. The tape is stretchable, conforms to most variations of surfaces and contours to which it is applied, and is extremely resistant to water, many chemicals and solvents. These qualities, plus effective performance throughout a temperature range of —50 to 225F and sustained flexibility at low temperatures, make the tape adaptable for many uses indoors and out. One outstanding property of the high-tack tape (according to the manufacturer) is the bond between permanent adhesive backing and the 4-mil polyethylene-film surface. The adhesive does not separate from the film, even when stuck to itself and then pulled apart.

Fasson Products, 250 Chester St., Painesville, Ohio.

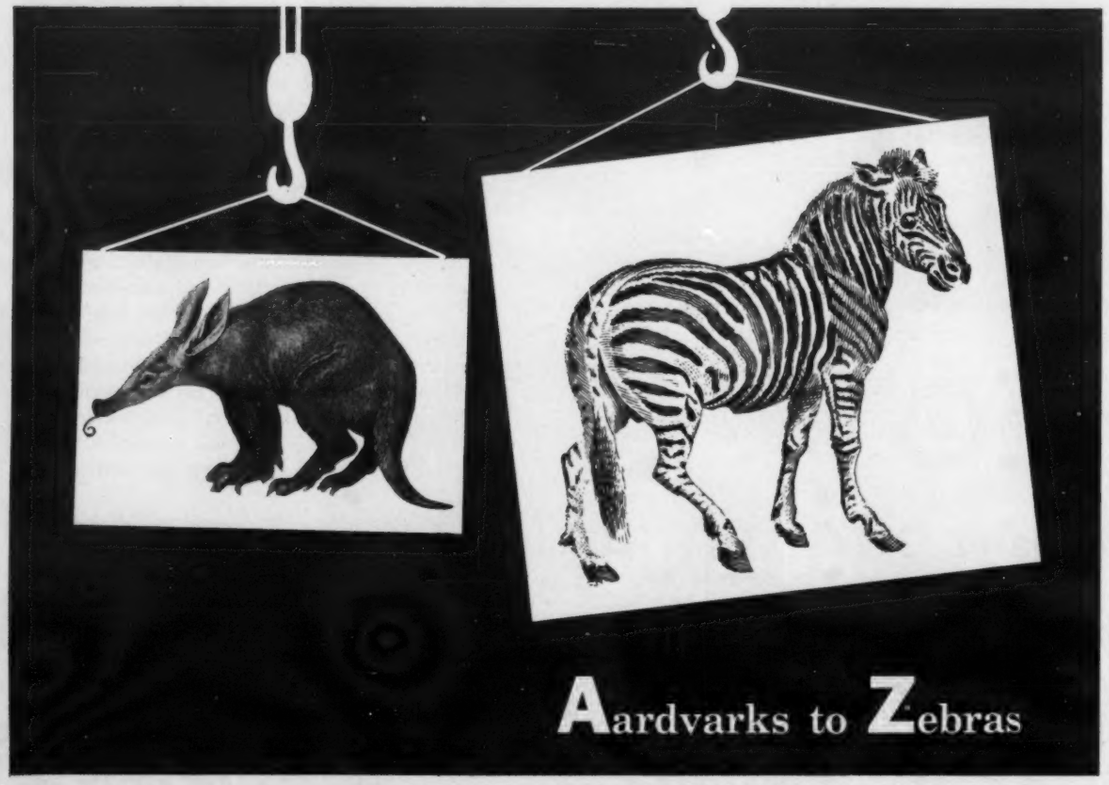
Epoxy Laminate 338

A thin, glass-cloth, epoxy laminate, qualified to MIL-P-18177B, is manufactured in continuous sheets, strips and coils of any length in thicknesses of 0.015, 0.022, 0.032 and 0.062 inch. The laminate exceeds NEMA G-10 and NEMA FR-4 requirements and also meets AIEE Class F specifications. The material (Code X6G-280) has good



dielectrics, high strength/weight ratio and good chemical and moisture resistance. Pore-free, high-dielectric surfaces are assured by "Mylar" which is bonded to both faces. Bond strength exceeds 750 psi (ASTM D-952). A second continuous, glass-cloth-reinforced laminate (Code X6G-278) exceeds NEMA G-10 and meets requirements of AIEE Class F and NEMA FR-4. It is available in thicknesses of 0.007, 0.010, 0.020, 0.032 and 0.062 inch.

Swedlow, Inc., Box 2324, Youngstown 9, Ohio.

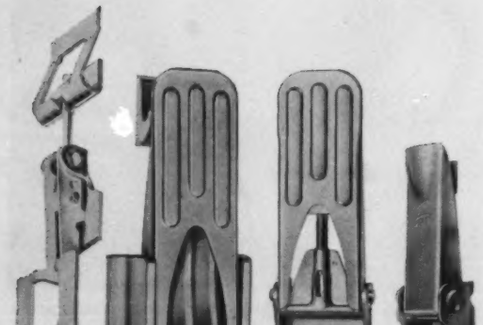


There's a Camloc Fasten/eered Universal Latch to do the job... and do it better!

You may never have to crate an anteater or ship a zebra. It's just one way of demonstrating the wide range of tensile strength requirements met by Camloc Universal Latches. For any job . . . from A to Z . . . 500 pounds or 4500 pounds . . . shipping containers or component assemblies of any size . . . Camloc can provide the latch to fill your specifications.

At Camloc the science of modern fastening is called FASTEN/ATION. And, FASTEN/EERED Camloc latches provide the ultimate in protection, ease of installation, and simplicity of operation. For example: draw hooks always stow flat when latches are open. Latches can't open under shock or vibration. Clean, crisp appearance enhances any product or component.

Have a special fastening or closure problem (even a reusable zebra case)? Camloc can provide a FASTEN/ATING solution. Write today for your copy of the full-line Camloc catalog.



37L — Ultimate tensile strength up to 4500 lbs. Short or long handle types.

46L — Ultimate tensile strength up to 1000 lbs. Aluminum or steel mounting bases and hooks.

46L (with adjustable draw hook) — All the features of type 46L plus draw hook adjustable over a ½" range.

51L — Ultimate tensile strength up to 500 lbs. Hook adjusts by simple rotation over 5/16" range.

specialists in fasteners for industry

CAMLOC®

CAMLOC FASTENER CORPORATION, 52 SPRING VALLEY RD., PARAMUS, N. J.

West Coast Office: 5455 Wilshire Blvd., Los Angeles, California • Southwest Office: 2509 W. Berry St., Fort Worth, Texas

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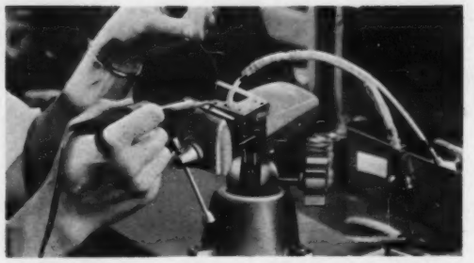
Circle 57 on Reader-Service Card for more information

EQUIPMENT

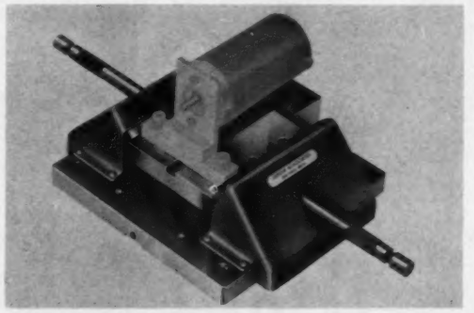
Work Positioners 339



By tightening one control knob on the side of this positioner, the head of positioner can be turned to any desired angle and set firmly to hold all sizes and shapes of small parts. Nylon jaws are available to protect delicate parts. Also offered in the line is a holder for all types of printed-circuit boards. Size of the work positioner illustrated is 6½ inches high and 5½ inches wide. Jaws will open to receive up to a 2½-inch part.

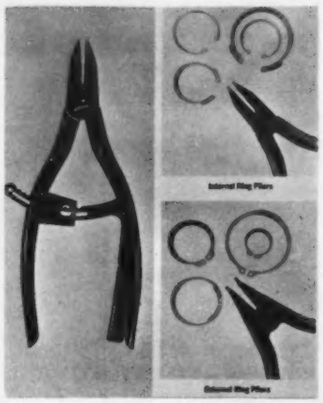
R. N. Hunter Sales Co., 9851 Alburtis Ave., Santa Fe Springs, Calif.

Torque Transducer 340



A transducer for torque sensing on tests of electric motors, generators, clutches and brakes, bearings and potentiometers is available in ranges from 50 oz-in to thousands of lb-in. Case reaction of the test unit is measured by means of bonded strain gages on special flexure straps that eliminate all friction error sources (such as bearings and linkages). Since no slip rings are employed, there is no limitation to speed of rotation and no maintenance requirements of bearings or brushes.

Lebow Associates, 14857 W. 11 Mile Rd., Oak Park 37, Mich.

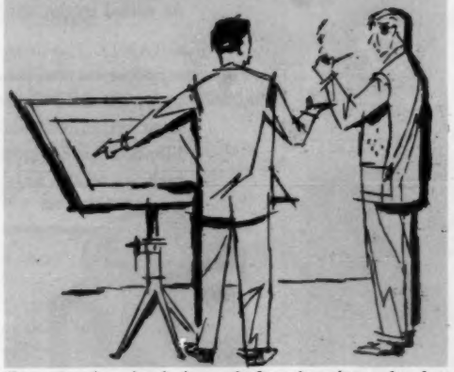


Two heavy-duty, retaining-ring pliers are offered for compression of internal-type rings for expansion of external rings. The No. 5R tool is designed to compress internal-type rings for assembly or disassembly in a bore or housing. The 6R pliers expand external rings for installation or removal over a shaft. The ratchet's locking action permits operator to install or remove a ring without maintaining constant pressure on handles and also serves as a safety device which prevents ring from springing loose accidentally. An adjustable positive stop on ratchet arm provides additional convenience and ring control. On the internal-ring pliers, the stop is used to preset spacing so that tips will be aligned automatically with holes in the ring. Presetting of pliers in this manner increases speed of ring assembly. On the external pliers, stop is set at the exact point of expansion necessary for ring to clear shaft. Both pliers are equipped with replaceable tips bent to a 15-deg angle to facilitate ring assembly and disassembly. For ring applications where clearance is limited, tips having a 45- to 90-deg angle are also obtainable. Tips are supplied in two diameters—0.087 and 0.116 inch—for different ring sizes.

Waldes Kohinoor, Inc., Truarc Retaining Ring Div., 47-16 Austel Place, Long Island City 1, N. Y.

Circle 58 on Reader-Service Card

WANT TO CUT YOUR SHAFT SEAL COSTS? TRY THIS APPROACH...



For example, why design a shaft seal engineered to last 10 years into a piece of machinery designed to last only 5 years? That seal costs too much for its application.

Research indicates that more than 50% of the face-type shaft seals in use today are "over-designed." Gits Bros. are specialists in cutting costs by eliminating such over-design, in part by proper use of a broad selection of newly developed materials.

It costs you nothing to let the Gits Engineering Staff check *your* face-type shaft seals for over-design, and you may stand to realize significant savings in costs.

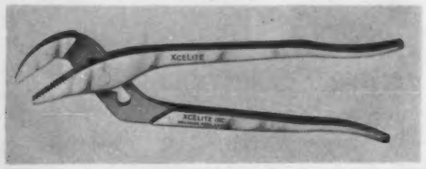
Whether your product is still on the drawing board or already in production, or if you use seals in Field Service Kits, just send us full details of the shaft seal application. Every day you delay sending this information can pile up those extra costs.

GITS BROS. MFG. CO.

1866 South Kilbourn Avenue • Chicago 23, Illinois

Specialists in Lubricating Devices and Shaft Seals for Over Half-A-Century

Utility Pliers 342



Forged alloy-steel utility pliers in 7- and 10-inch lengths feature double-strong box-joint construction and flush-ground rivet pin. For use on flat, square, hex or round-shaped objects, pliers are designed to produce powerful leverage in each of four gripping positions with no side-twist or strain. Simple, lever-action movement of the handle quickly adjusts serrated jaws to desired opening. Measuring only 5/16 inch at its thickest point, the 7-inch model adjusts to 1-1/16-inch opening.

Xcelite, Inc., Orchard Park, N. Y.

Pin Straighteners 343

Pin straighteners are now supplied in three models. The original bench-mounted models SH-17 and SH-19 are now supplemented by two additional designs. The SH-79, a convenient hand tool, may be carried in the tube caddy. It combines a 7-pin straightener on one end with a 9-pin straightener on the opposite end. The SH-97P offers a separate pair of 7- and 9-pin straighteners, for mounting on a chassis in standard cutouts for miniature tube sockets. Used for straightening the pins of 7- and 9-pin miniature tubes before inserting them in their sockets, the devices help avoid broken tubes and damaged sockets by preventing glass strains.

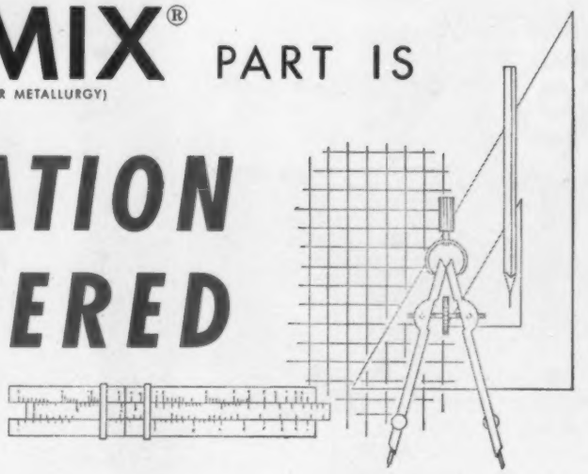
CBS Electronics, Div. of Columbia Broadcasting System, Inc., Danvers, Mass.

TO INSURE SUCCESSFUL PERFORMANCE

EVERY GRAMIX® PART IS

(PRODUCTS OF POWDER METALLURGY)

APPLICATION ENGINEERED

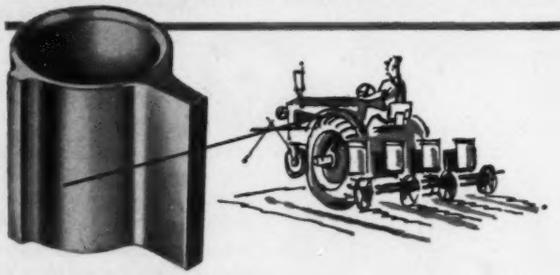


One of the most important factors to consider when purchasing powder metal parts is that of successful part performance; for a part to successfully perform its job, all of its physical and metallurgical characteristics must be suited to the application.

GRAMIX Products of Powder Metallurgy are always *Application Engineered*, which means product is specially matched to each specific application. From an almost unlimited variety of metal mixtures, one alloy is blended that contains the required properties and characteristics of the finished part; *all* aspects of part design and conditions under which it must operate are taken into account. Only then is the GRAMIX part produced.

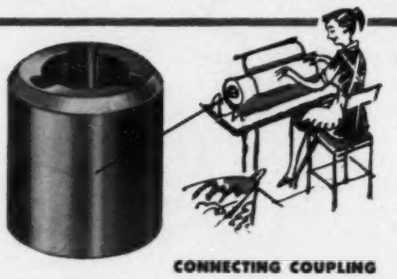
Eight of these *Application Engineered* GRAMIX parts are shown here. Each precisely suits the requirements of its job . . . each is the best part available for the job.

When you specify a GRAMIX part, you can always be sure that it has been *Application Engineered* for successful performance, long life and complete reliability. For more information on *Application Engineered* GRAMIX parts, write for Engineering Handbook G-55.



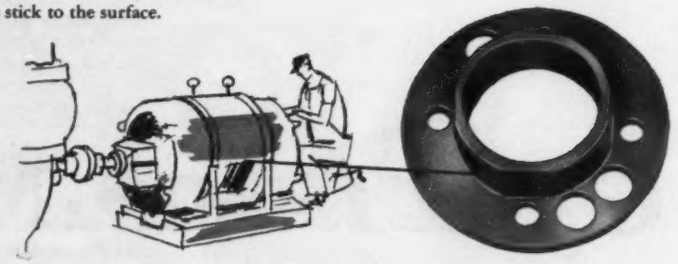
CORN SEEDER

GRAMIX was the material specified for this corn seeder part because the surface finish obtainable with the alloy used reduced the tendency of material to stick to the surface.



CONNECTING COUPLING

The connecting coupling employed in a small home ironer is formed from a special GRAMIX hardened steel alloy; it offers low wear and shock resistance.



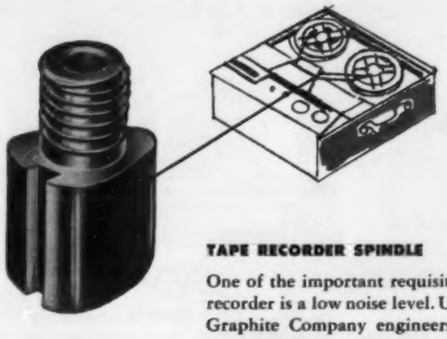
CONTAINER COVER END CAP

Great savings were realized when retainer caps for certain types of electric motors were made of GRAMIX.

This process made it simple and economical to mold the multiple holes to precise tolerances without extra operations.

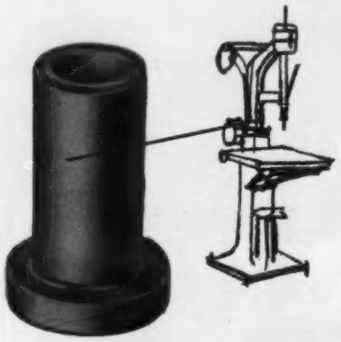
HELICOPTER THRUST WASHER

The outstanding features of the GRAMIX alloy specified for this thrust washer are a dependable and consistent friction and wear pattern as well as a fine surface finish.



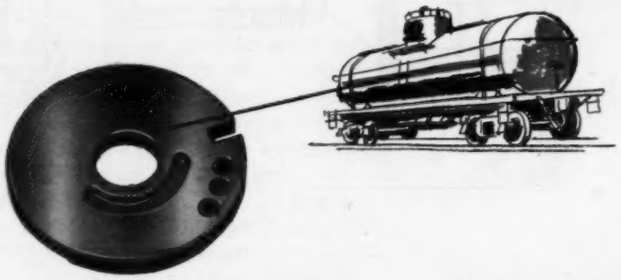
TAPE RECORDER SPINDLE

One of the important requisites in a tape recorder is a low noise level. United States Graphite Company engineers developed a special alloy to meet these requirements in the GRAMIX spindle.



GUIDE BEARING

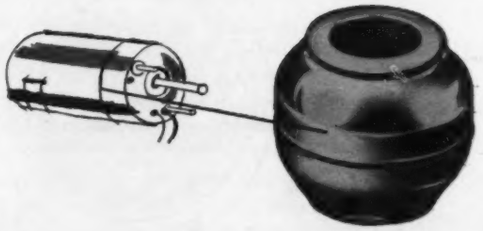
Built-in lubrication and low friction to reduce heat are important features of the GRAMIX alloy chosen for this guide bearing.



LIQUID PUMP END PLATE

This end plate is typical of many parts employed in liquid pumps of many types.

It is made from a wear resistant bronze alloy that was developed for pump applications.



FRACTIONAL H.P. MOTOR

The GRAMIX bearing for this Fractional h.p. motor was developed from a special low noise level alloy.

Its self-lubricating properties were also an important consideration in specifying GRAMIX.

METAL POWDER mpi INDUSTRIES FEDERATION

X-296-2

THE UNITED STATES GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION, SAGINAW 2, MICHIGAN

GRAPHITAR® CARBON-GRAPHITE • GRAMIX® POWDER METALLURGY • MEXICAN® GRAPHITE PRODUCTS • USG® BRUSHES

Circle 59 on Reader-Service Card for more information

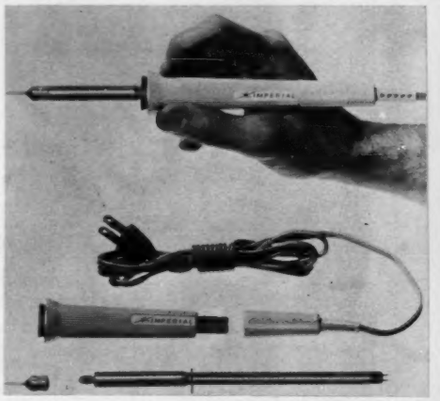
Thermal Wire Stripper 344

This dual-position wire stripper, Model WS17B, provides all the equipment necessary for two operators working side by side. With no blades to score or sever wire strands, stripper substantially reduces failure and rejection of electronic assemblies, thus increasing system reliability. It handles all size wires from AWG No. 6 to 36 and coaxial cable as well. The long-life alloy tip need not be changed.

The unit strips "Teflon", nylon and other plastic insulation. The inexpensive, replaceable tips last for 80 hr of intermittent operation. Other models available include a four-position model and a special unit featuring an outlet for 7.5v soldering iron.

American Missile Products Co., Inc., 15233 Grevillea Ave., Lawndale, Calif.

Soldering Iron Kit 345



A new concept in soldering irons features complete interchangeability of components from cord sets to tips. The components, which can be purchased separately, include: 25, 30 and 40w heat cartridges; three pastel-colored "Perma-Cool" handles; three types of color-keyed cord sets—grounded three-wire NEMA, grounded three-wire with stripped end and standard two-wire. A total of 42 "Mini-Tip", interchangeable, thread-on soldering tips is available in iron clad, 24k gold-plated, Armco iron and tellurium copper, providing complete versatility for every soldering application. The slim rugged handles are made of high-strength polycarbonate resin. Handles and cord sets are offered in three color shades: turquoise, beige and ivory.

Ungar Electric Tools, Electronic Div. of Eldon Industries, Inc., 1475 E. El Segundo Blvd., Hawthorne, Calif.

"Jeep" Industrial Engines power hi-lift trucks.

IT TAKES A DEEP BREATH,
AND EXHALES EXTRA POWER

'Jeep' F-head INDUSTRIAL ENGINE

Big intake valves and preheated air help this rugged design top 70 horse-power. Its combustion chamber encourages high compression on regular fuels. It is the only F-head built in America today.

Weight and balance are so perfectly exploited in this 4 cylinder design, that its smooth performance, plus power, can often replace 6 cylinders with all the contingent savings in engine expense and heavy engine supports.

Send for catalog giving details and power curves.
LP Gas and Marine Conversion Kits available.

KAISER WILLYS MOTORS

WILLYS MOTORS, INC.
INDUSTRIAL ENGINES DEPT.
TOLEDO, OHIO

Manufacturers of 4 and 6 Cylinder 'Jeep' Industrial Engines

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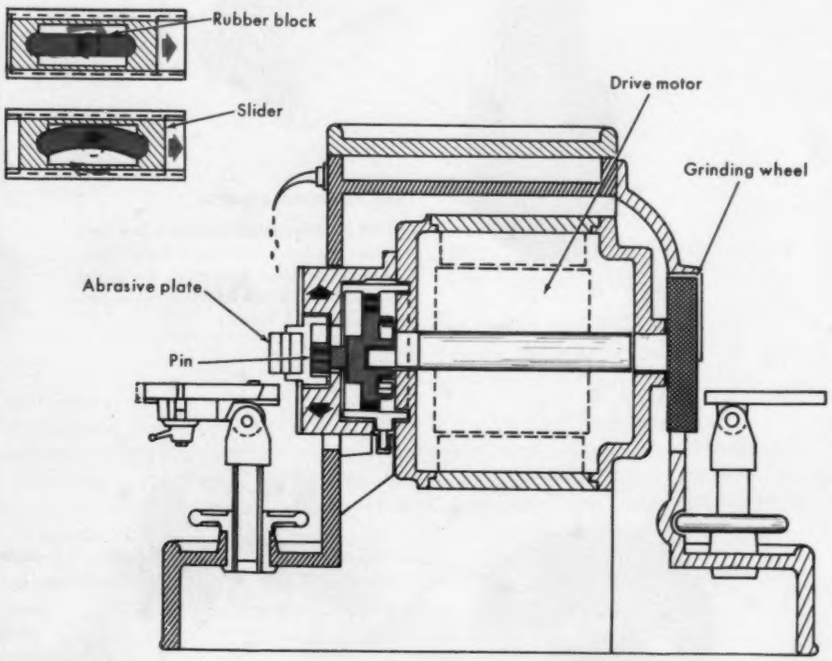
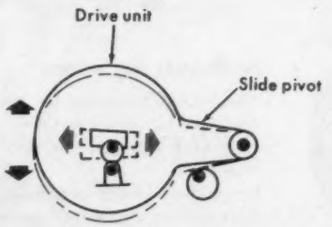
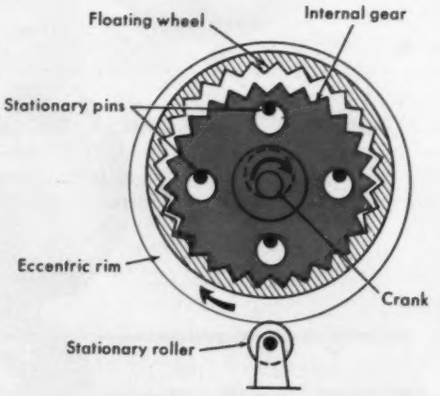
Rubber Block Forms Simple Linkage for Compound Motion

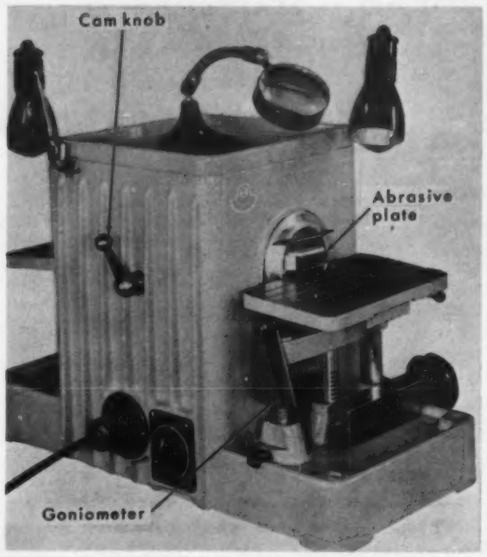
Celestino O. Lubatti, Italian Editor







CRANKPIN on motor shaft carries floating wheel in mesh with successive teeth of internal gear. Stationary pins permit cranking motion of floating wheel but prevent rotation about its axis. Since internal gear is two teeth larger than floating wheel, eccentric rim slowly rotates over stationary roller. Drive unit oscillates vertically about side pivot by 5 deg. Knob-actuated cam lifts drive unit to eliminate oscillation when grinding wheel is used. The 0.5-hp drive motor reciprocates abrasive plate at 2800 strokes per minute.



SINGLE MOTOR drives diamond-dust grinding wheel (on back) and abrasive plate. Carbide-tipped tools are roughly shaped on normal grinder and semifinished on diamond wheel. Sliding plate, also formed with diamond dust, laps tool face horizontally, thereby eliminating edge indentations left by grinding wheel. Highly finished edges reduce carbide wear, improve tool performance. Goniometers indicate table inclination for correct tool angles.

A rubber block restrained on the sides simplifies the different-speed drives which move the abrasive plate of a lapping machine in perpendicular directions. Cranking movement of the vertical-drive floating wheel is changed directly into horizontal reciprocation to eliminate metal linkages. The resilient rubber minimizes vibrations and wear at 2800 strokes-per-minute working speed, reduces space and weight of oscillating unit.

An axial pin on the floating wheel cranks the rubber block. The vertical component bends the rubber piece in alternate directions; the horizontal force reciprocates a guided slider holding the abrasive plate. Vibration-free linear lapping permits a smooth finish of tool edges normally unobtainable from revolving grinders.

An internal gear surrounding the floating wheel produces relatively slow vertical oscillation of the whole drive to enlarge working area of abrasive plate. The eccentric gear-rim rotates over a stationary roller, causing one vertical oscillation per gear revolution. The floating wheel turns the internal gear by only two teeth in one revolution of the motor shaft, thus making vertical motion considerably slower than the horizontal. According to the manufacturers, Officine Meccaniche Melchiorre, Milan, Italy, this machine is particularly suitable for edge finishing of carbide-tipped tools.

The only true measure of **eyelet price** is **Installed Cost**

*IC Installed Cost . . . not the initial cost of eyelets, but the total cost when the eyelets have been installed in your product.

and United helps you cut IC all four ways

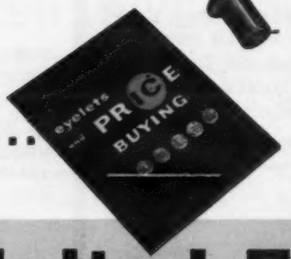
lower tooling costs . . . because of United's system of Standardized Eyelets—with only 7 sets of tools needed for all 65 eyelet sizes!

lower engineering costs . . . because United offers you a complete design and application engineering service. In addition, United Standardized Eyelets keep your specification time to a minimum.

lower down-time costs . . . because United's lines of eyeleting machines, setting tools and high-precision eyelets form an integrated production team that cuts your losses from stoppages and re-works. And with only 7 sets of tools needed to handle all 65 sizes of United Eyelets, down time for tooling changes is greatly reduced.

lower acquisition costs . . . because United's system of Standardized Eyelets greatly simplifies specifying and ordering procedures. United's local service and prompt deliveries avoid costly delays and eliminate the expense of maintaining large eyelet or tool inventories.

for all the dollar-saving facts . . . in United's Installed Cost story, ask today for your free copy of the new bulletin "Eyelets and Price Buying." Simply phone the United office in your area or write direct to Shelton Division, United Shoe Machinery Corporation, 1555 River Road, Shelton, Connecticut.



United Eyelets

Shelton Division UNITED SHOE MACHINERY CORPORATION Shelton, Connecticut

BRANCHES: ATLANTA, GA. • CHICAGO, ILL. • CINCINNATI, CLEVELAND AND COLUMBUS, OHIO • DALLAS, TEXAS • HARRISBURG, PA. • JOHNSON CITY, N.Y. • LOS ANGELES, CALIF. • LYNCHBURG, VA. • MILWAUKEE, WISC. • NASHVILLE, TENN. • NEW YORK, N.Y. • PHILADELPHIA, PA. • ROCHESTER, N.Y. • ST. LOUIS, MO.

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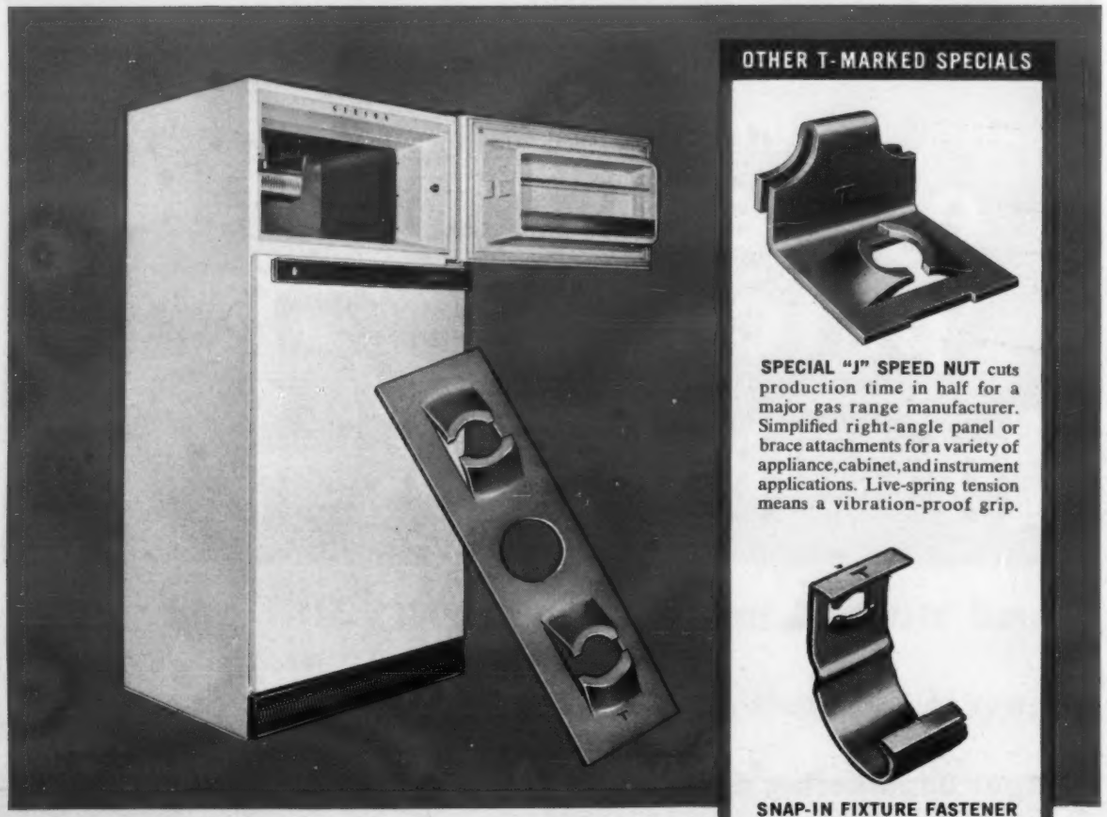


A Tinnerman T-Marked Original...

Dual SPEED NUTS® open door to 20% savings on as-assembled cost

Gibson refrigerator door hinges are held in place with new cost-cutting, time-saving twin-type SPEED NUTS. They replace 3/16" plate hinge retainers which had to be drilled and tapped for machine screws.

Gibson Refrigerator analysts estimate that special twin-type SPEED NUTS save 14% on the cost of each hinge retainer assembly, 20.5% on the as-assembled cost. Labor is reduced by half. Former problems with cross-threading and stripping are eliminated . . . SPEED NUTS and A-type screws go together naturally every time—and faster!

The T-mark of quality and dependability identifies the more than 10,000 variations of SPEED NUT brand fasteners. From this unlimited selection come many saving opportunities for you. Ask your Tinnerman representative to arrange for a free FASTENING ANALYSIS of your product. An engineering service that may produce similar savings for you.

You'll find Tinnerman under Fasteners in your SWEET'S Product Design File and in the "Yellow Pages." *Tinnerman Products, Inc., Dept. 12, Box 6688, Cleveland 1, Ohio.*

OTHER T-MARKED SPECIALS

SPECIAL "J" SPEED NUT cuts production time in half for a major gas range manufacturer. Simplified right-angle panel or brace attachments for a variety of appliance, cabinet, and instrument applications. Live-spring tension means a vibration-proof grip.

SNAP-IN FIXTURE FASTENER developed specially for Imperial Lighting Products Co., trimmed 80% off lighting fixture assembly time. Once fastened to the ceramic socket, this unique SPEED NUT snaps quickly into the fixture base...replaces three parts.

PUSH-ON SPEED NUT anchors latching bars on steel desks, reduces material and assembly costs by 50%. Push-on SPEED NUTS can be attached on studs, rivets, or tubing in a split second, and eliminates need for threaded parts . . . saves time and money.

TINNERMAN Speed Nuts®
Look for the Tinnerman "T"

CANADA: Dominion Fasteners Ltd., Hamilton, Ontario. GREAT BRITAIN: Simmonds Aerocessories Ltd., Treforest, Wales. FRANCE: Simmonds S.A., 3 rue Salomon de Rothschild, Suresnes (Seine). GERMANY: Mecano Simmonds GMBH, Heidelberg.

Circle 62 on Reader-Service Card for more information

Hardened Particles Increase

E. J. Stefanides, Central States Editor

A new material used in the construction of safes is designed to resist pressure-applied carbide cutting tools. These tools, which have been successful against the case-hardened steels formerly used for drill protection, are ineffective when applied against the new material.

The material, which has been designated "Infusite", consists of a special alloy, highly resistant to high temperatures, with solid hardened particles in suspension.

The drill-proof components are fabricated by casting the molten alloy with the insoluble particles in suspension in the fluid metal. When attacked by drilling, the alternate soft and hard strata of the nonhomogeneous material subject the drills to impact stresses which cause them to chip or shatter. The harder the drill and the greater the drilling pressure, the more likely chipping or shattering will occur.

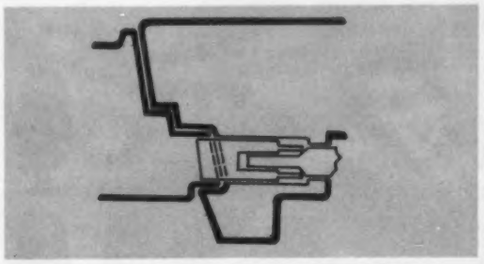
The material is used in a new line of tool- and torch-resistant safes which are intended for the accumulation of bulk sums for bank deposit and overnight burglary protection.

For added security, these safes also employ a breech-type door, having locking lugs on both the door and body jams with three locking bolts of a new design. These bolts are of driveproof construction to provide security against attack by drift pins, sledges and other attempts to force the bolt from behind the locking lug.

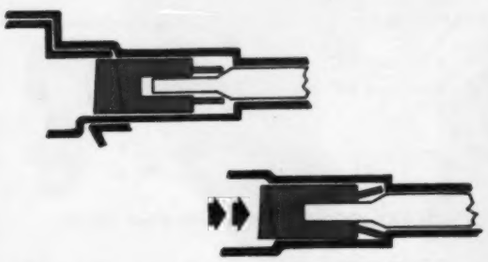
One of the lines also features a full front insert of copper plate and an inner ring of copper around the inside of the door opening for further protection against torch attack. The copper, because of its high thermal conductivity, conducts torch heat away so rapidly that it becomes impractical to burn through the front of the safe or the locking lugs and bolts with an acetylene torch.

The safes are designed and manufactured by Diebold, Inc., Canton, Ohio, who also developed the "Infusite" material.

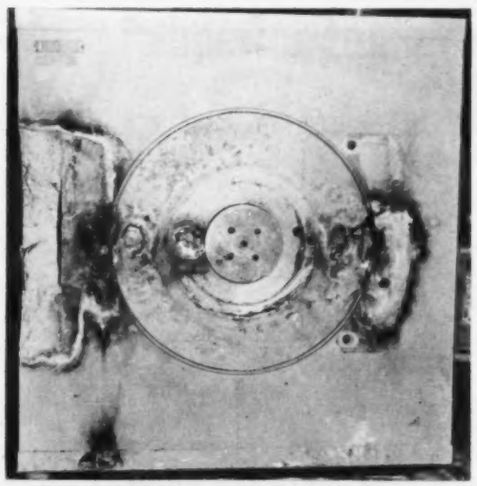
Alloy's Tool Resistance



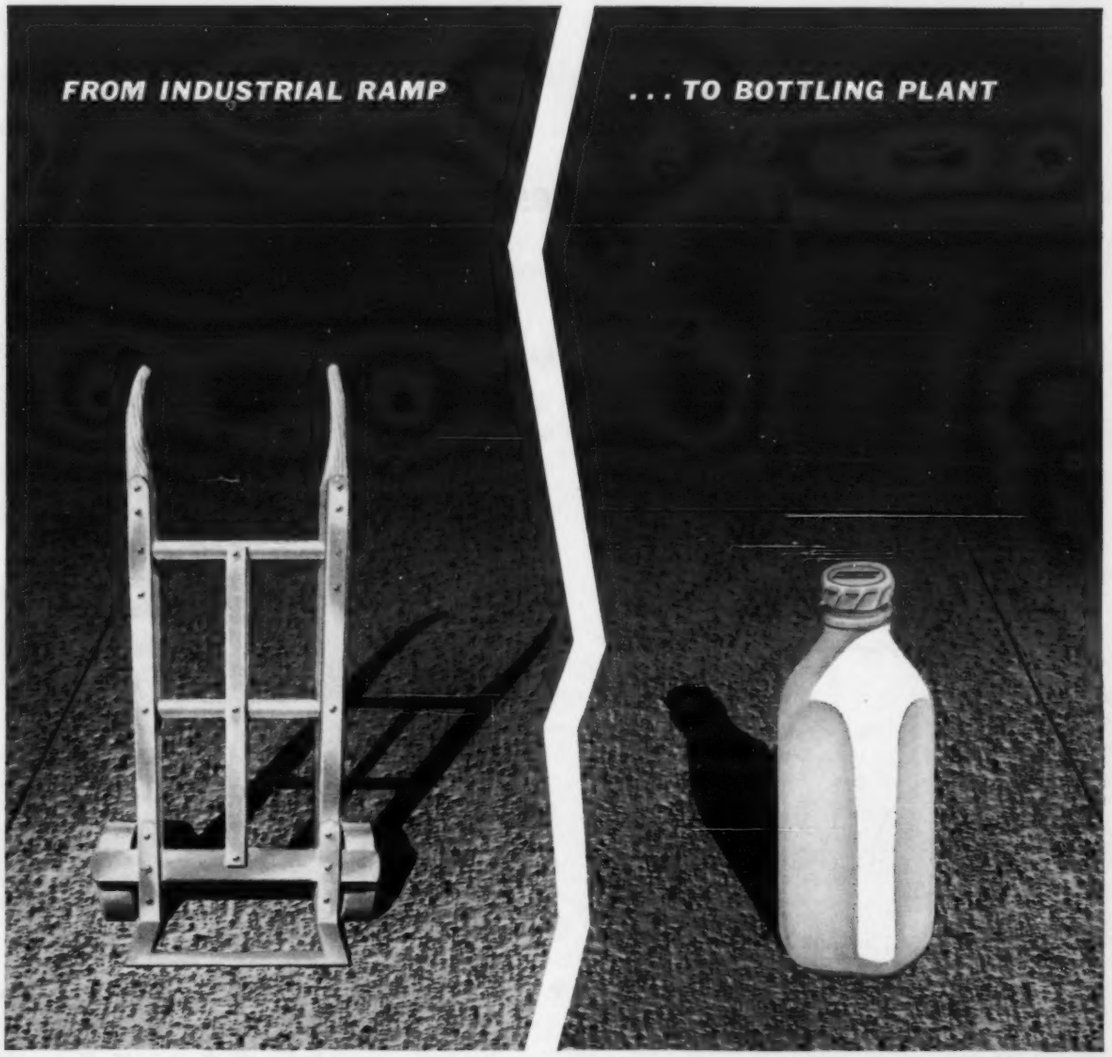
PROTECTION against carbide tools is provided by completely covering door and front of safe with "Infusite".



DRIVEPROOF CONSTRUCTION of locking bolt protects against attacks which attempt to force bolt from locking lug. As bolt is driven back, outer sleeve expands, wedging bolt in locked position.



EFFECTIVENESS OF TORCH AND TOOL PROTECTION is demonstrated by safe which was subjected to attack by criminals using torch, high-speed tipped drills and sledges. Burglars were not successful and serviceman required an additional 18 hours to gain entrance for salvage of contents.



Abrasive particles are rolled densely and uniformly into high-quality steel and act as friction grips for safe footing.

There's never a slip on A.W. ALGRIP
(the only ABRASIVE rolled steel floor plate)

Step up your plant safety with Algrip—the world's only abrasive rolled steel floor plate. It provides safer footing where splashing water, grease, oil, ink mist or other slippery substances might otherwise pose serious plant hazards. Even on steeply inclined surfaces, Algrip creates firm traction for workmen's shoes and the wheels of rolling stock.

This high quality steel plate is light enough to use as flooring overlay and is strong enough for independent flooring. Fabrication is simple. You can shear, form, weld and drill it with standard shop equipment. Fire and chemical resistant, Algrip flooring is approved for safety by Underwriters' Laboratories. Write today for Bulletin AL-S3.

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DESIGN DATA NEWS

Nomogram for Hoop Stress in Rotating Rings

S. J. Salva and W. R. Morey, Jackson, Mich.

This nomogram solves for maximum tensile hoop stress in free rotating rings of various densities and rim velocities:

$$S = 12wV^2/32.2$$

Where:

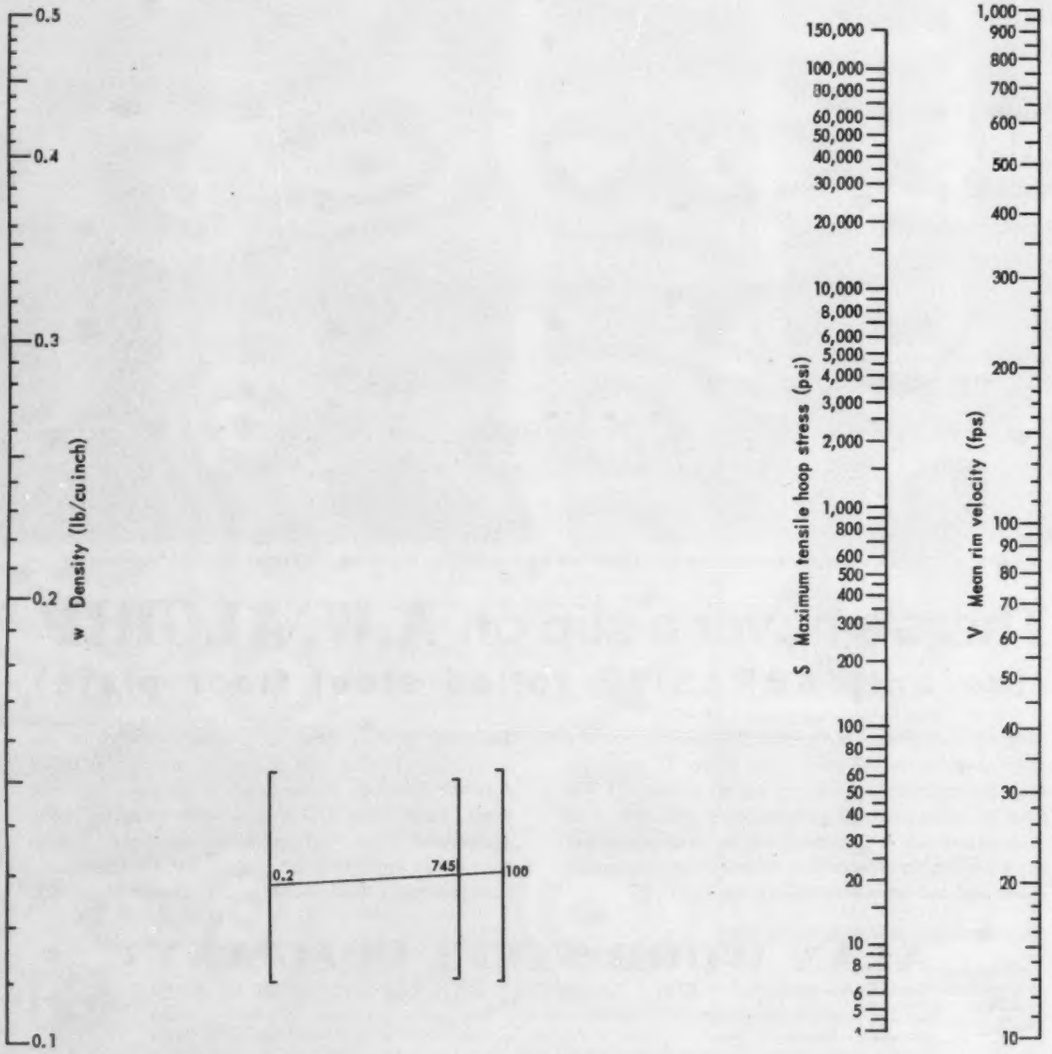
S = maximum tensile hoop stress, psi
w = density, lb/cu in
V = mean rim velocity, ft/sec

Example:

Determine the stress in a thin ring with a density of 0.2 lb/cu in and a rim velocity of 100 ft /sec.

Solution:

Align w = 0.2 with V = 100 and read S = 745 psi.



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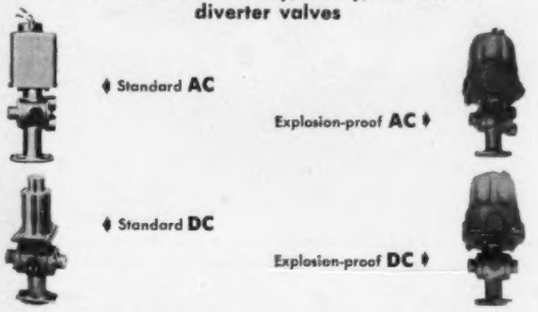
Barksdale AIR-SEAL* Valves for the nerve centers of production

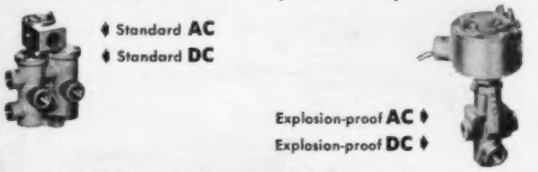
*The air pressure is the sealing force; the higher the pressure, the tighter the seal.

DIRECT SOLENOID 4-way, 3-way, shut-off and diverter valves



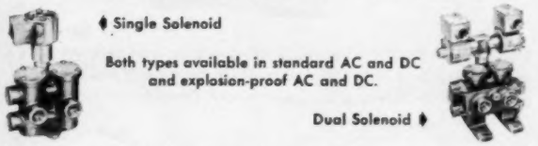
♦ Standard **AC**
Explosion-proof **AC** ♦
♦ Standard **DC**
Explosion-proof **DC** ♦

SOLENOID-PILOT 4-way and 3-way valves



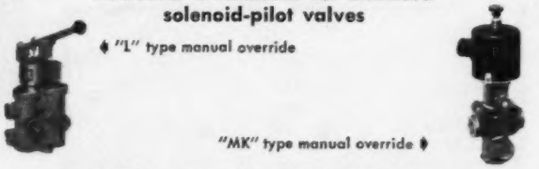
♦ Standard **AC**
♦ Standard **DC**
Explosion-proof **AC** ♦
Explosion-proof **DC** ♦

MOMENTARY CONTACT solenoid-pilot valves



♦ Single Solenoid
Both types available in standard AC and DC and explosion-proof AC and DC.
Dual Solenoid ♦

MANUAL OVERRIDES for standard solenoid-pilot valves



♦ "L" type manual override
"MK" type manual override ♦

MANUAL and FOOT OPERATED valves

Manual 4-way
Manual shut-off
Foot operated 4-way

Write for air valve catalog (AV-9) which contains complete data and prices on 562 different valves (not counting voltage variations).

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TubeXperience in Action

Superior tubing makes pressures behave

whether 125, 5000, 30,000 or 100,000 psi

Superior small-diameter tubing makes pressures behave whether low, medium, high or super. Superior pressure tubing can be roughly divided into two groups: commercial pressure tubing for use in a range up to 20,000 psi; premium super pressure tubing to handle pressures from 15,000 to 100,000 psi. Both ranges can be handled effectively by a number of different analyses, depending on service requirements. Typical applications for Superior general-purpose pressure tubing include pressure tools, machine tools, heat exchangers and condensers. Superior super-pressure tubing is found in hydrogenation process equipment, high-pressure autoclaves, and pilot plant installations in chemical and oil refining plants.

All Superior pressure tubing offers many advantages. It helps prevent critical failures and downtime. It assures long service life, high fatigue strength, excellent corrosion and chemical resistance. In the range from 15,000 to 100,000 psi, Superior super-pressure tubing is a premium product. It is produced from specially selected raw materials. Inside surfaces are conditioned to remove fissures and other defects. During processing, special degreasing operations are performed, and the inside diameters are conditioned to insure a clear, smooth surface. Two types are available: a single wall mechanical tubing and a double wall, or composite unit, made from two thinner tubes. It is produced in an annealed condition and in ⅛ hard temper, and to mechanical properties specified by the customer. All Superior pressure tubing is 100% hydrostatically tested to recommended working pressures, and rigidly inspected for defects.

We can probably help you with any tubing problem that may confront you . . . in pressure, super-pressure or other applications. Contact us and feel no obligation. Superior Tube Company, 2002 Germantown Ave., Norristown, Pa.

Superior Tube

The big name in small tubing

NORRISTOWN, PA.

All analyses .010 in. to ⅜ in. OD—certain analyses in light walls up to 2½ in. OD

West Coast: Pacific Tube Company, Los Angeles, California • FIRST STEEL TUBE MILL IN THE WEST

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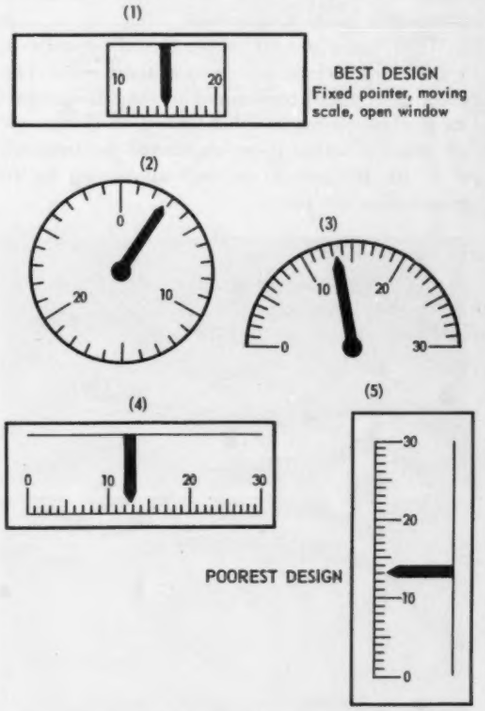
Designing Meters For Maximum Reading Efficiency

Joseph L. Seminara,
Lockheed Aircraft Corp., Sunnyvale, Calif.

Relative Legibility of Scale Designs

Tests have proved that the design of a meter scale has a definite effect on the legibility of the meter. Of the five designs compared, the open-window design proved best, while the vertically oriented



scale produced the greatest number of reading errors. The relative superiority or inferiority of one design over another is indicated when any of the following factors is present: fatigue, boredom, stress, distractions or poor illumination.

Complexity of Scales

Choose the least complex meter commensurate with requirements of the situation. Meters often are used incorrectly to provide purely qualitative information. In cases where trend information is not required, consider use of indicator lights.

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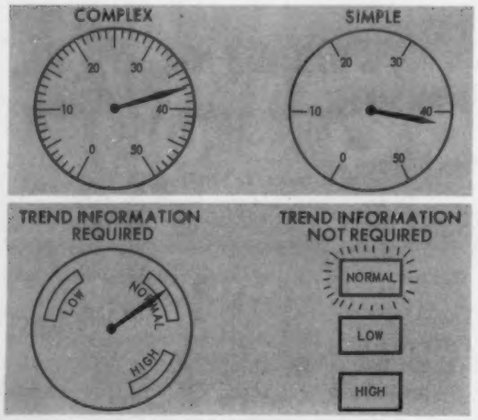
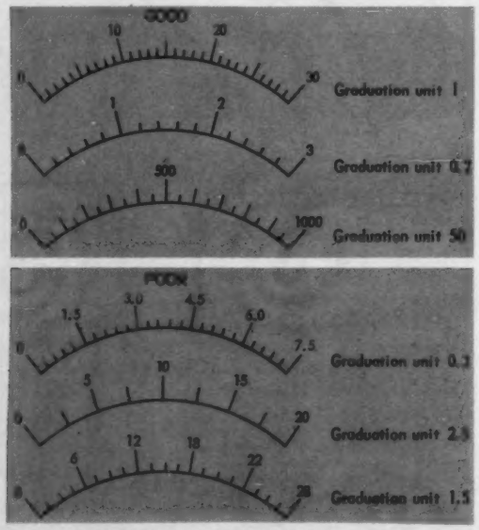


Acceptable Scale Progressions

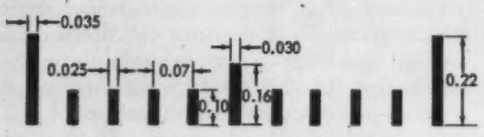
Meter scales should be graduated in units of 1, 2, 5 or in decimal multiples of these units. The number of minor graduation marks between major graduation marks should not exceed nine. Of all possible scales, those numbered by intervals of 1, 10, 100 and so on and subdivided by 10 graduations are best.

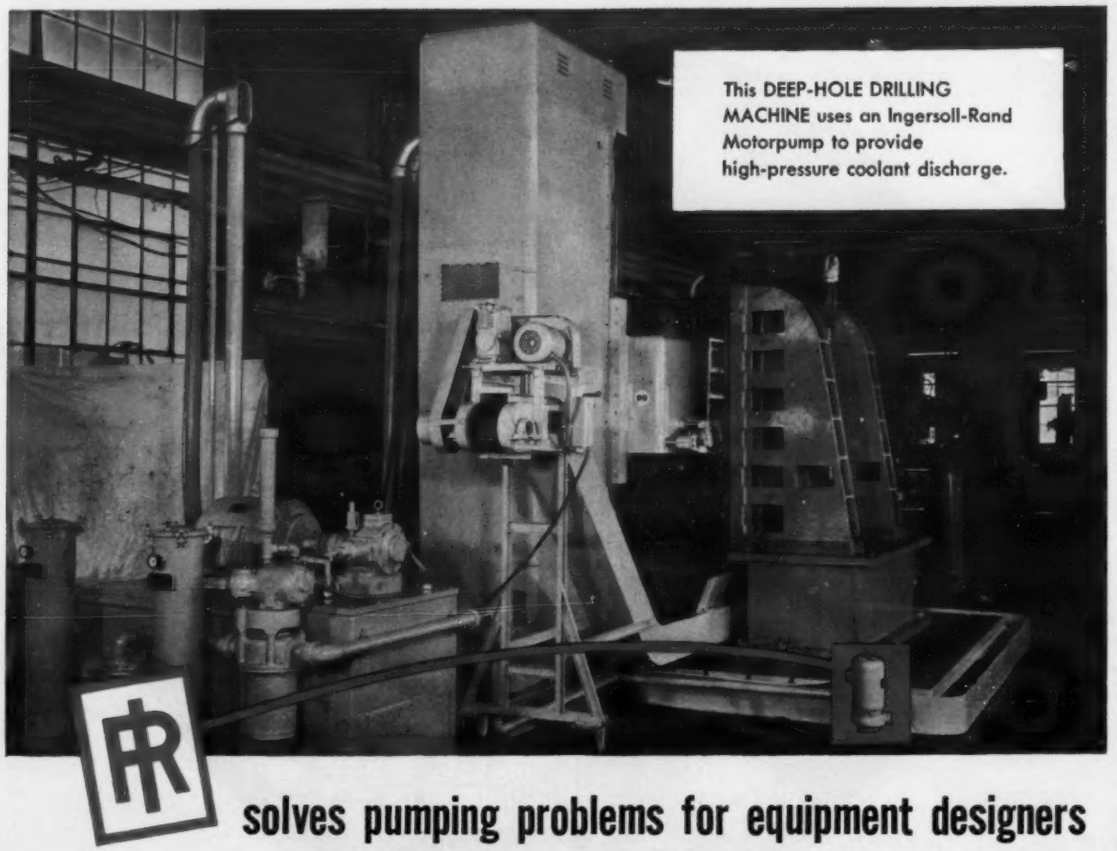


Dimensions for Meter Scale Markings

The recommended dimensions for meter scale markings vary with illumination conditions in the work area.

Low-Intensity Illumination (less than one foot-candle):





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¼ through 20 hp delivery to 1000 gpm
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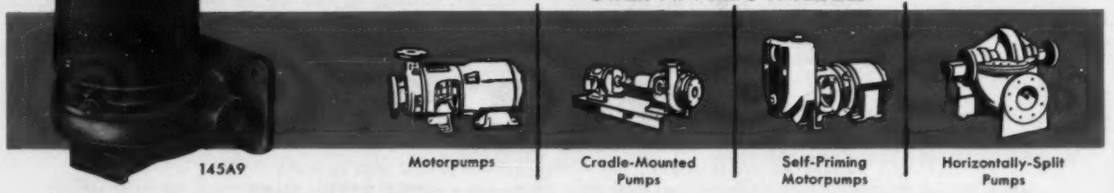

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Ferry Cap **Countr-bor** Screws Give Barco High Pressure Steam Joints Required Strength At Lowest Cost

Barco Manufacturing Company needs high strength screws of unquestionable quality for high pressure swivel joints capable of handling fluids at 1,000° to 1,200°F or steam at up to 850 psi. Their investigation found that Ferry Cap Countr-bor Screws are the only suitable heat-treated screws that provide tensile strengths of 170,000 psi minimum at moderate cost.

You get these advantages from Ferry Cap Countr-bor Screws:

- Wrench tighter and faster . . . 3 times the gripping surface of socket head screws.
- Fit in standard counterbored holes . . . wrench externally with standard socket wrenches.
- Improve appearance.
- Cost up to 20% less than regular socket head screws.
- High-strength, heat treated alloy steel.
- Sizes from No. 10 through 1".

Free testing samples and literature on request.

F-C **Ferry Cap & Set Screw Company**

2151 Scranton Road, Cleveland 13, Ohio

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Adequate or Normal Illumination (above one foot-candle): Separation between graduation marks can be reduced to a minimum of 0.035 inch.

Smaller graduation marks may be used, but the same general proportions of minor and major marks should be maintained.

Size of Scale Numerals

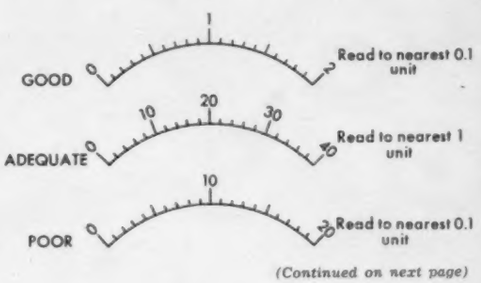
The recommended size of meter scale numerals varies with illumination of the work area and the importance of the metered function. For a 28-inch reading distance, the following numeral dimensions are recommended:

HEIGHT OF SCALE NUMERALS IN INCHES FOR NORMAL READING DISTANCE		
Nature of metered function	Low level illumination	Normal illumination
Critical	0.15–0.30	0.10–0.20
Non-critical	0.05–0.20	0.05–0.20

Reading Accuracy

In considering the accuracy requirement for a metered function, inherent sensitivity of the meter and the reading accuracy that can be expected from the operator must be taken into account. It is a waste of money to provide an ultra-sensitive meter only to have the operator compromise overall accuracy because the scales provided do not permit readings to the required accuracy. Similarly, it is a waste of effort to require the operator to read to 0.1 percent when meter sensitivity is 3 percent. Generally, the operator should not be required to interpolate between adjacent scale markers. Therefore, if accuracy to the nearest 0.1 unit is necessary, the smallest graduation unit should be 0.1.

In cases where the size of the scale is limited, an interpolation of one unit between graduation marks is acceptable. However, where finer interpolations are made, the magnitude of errors can be expected to increase.



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Designing Meters . . . *Cont.*

Meter Size

The selection of the correct size of meter is important to the designer who has a space problem and does not want to compromise reading accuracy. Factors that determine required meter size are: (a) number of graduation marks comprising the scale, (b) minimum recommended separation between graduation marks and (c) distance from which the meter must be read. The general formula for determining circular scale diameter is:

$$(S)\ (N)\ /\pi = D$$

Where:

- S = space between graduation mark midpoints
- N = number of graduation marks
- D = circular-scale diameter

Example: Given 100 graduation marks and normal illumination, a minimum scale diameter of 1.1 inches is required [(0.035) (100) / (3.14) = 1.1].

Values given above assume a normal console reading distance of 28 inches. When meters must be read at a greater distance, multiply the calculated diameter (D) by:

Reading Distance/28

Meter Pointers

Meter pointers should extend to, but not overlap, the smallest scale graduation mark. Pointer tip should be no wider than the smallest graduation thickness. Color of the pointer, from the center of rotation to the tip, should be the same color as the scale markings. The non-pointing end (if visible) should be the same color as the dial background. The pointer tip should be placed as close as possible to the meter scale dial to minimize parallax errors.

Orientation of Numerals

Numerals on meter scales should be oriented in the normal reading position. Radial presentations on circular scales are poor design.

ALMOST ANYTHING CAN BE IMPROVED... IN PLASTICS MOLDED BY GENERAL AMERICAN

John T. Riddell Inc. wanted safer one-piece helmets for pro football. General American helped provide the answer.

Now every player on every professional football team can enjoy a new measure of protection against injuries. General American worked with the John T. Riddell Co., engineered a "collapsible" mold which made possible the production of one-piece plastic helmets to rigid specifications. These helmets have been proved in gruelling play (and even more gruelling laboratory tests.) The man at the bottom of a pile-up or at the business end of a cleat is safer than ever before.
Resourceful solutions like this are not at all exceptional at General American's Plastics Division. Our engineers and plastics specialists are backed by the largest, most varied molding facilities in the world: compression presses to 2000 tons . . . injection presses to 300 ounces . . . large extruding and vacuum-forming machines unmatched anywhere.
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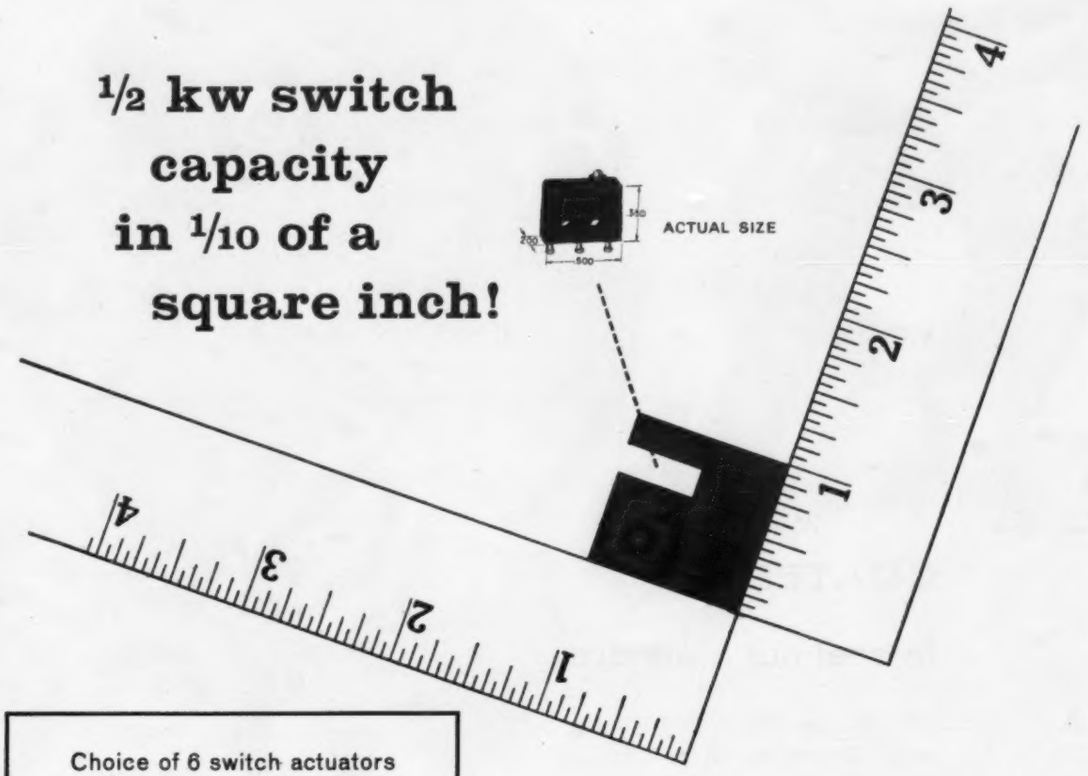
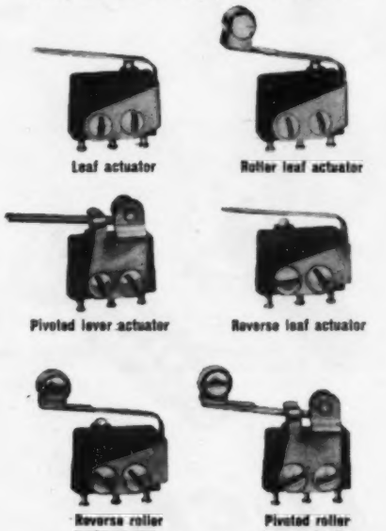
H HONEYWELL **MICRO SWITCH Precision Switches**

½ kw switch capacity in 1/10 of a square inch!



Choice of 6 switch actuators



THE MICRO SWITCH "1SX1" is the smallest single-pole double-throw snap-action switch made. It weighs only 1 gram. Yet, despite its tiny size, it performs millions of operations, in temperatures ranging from −65° F. to +250° F. And it handles precision switching jobs at capacities up to ½ kw.

The case, cover and plunger are made of high-strength plastic. Contacts are fine silver. The unique, snap-action spring is beryllium copper. The case has two mounting holes that accept No. 2 screws. One hole is slightly elongated to facilitate mounting. "1SX1" is designed to conform to MS24547-1.

MICRO SWITCH manufactures a complete line of small basic switches. See the Yellow Pages for your nearby MICRO SWITCH Branch Office. Or write for Catalog 63.

MICRO SWITCH . . . FREEPORT, ILLINOIS
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MICRO SWITCH Precision Switches

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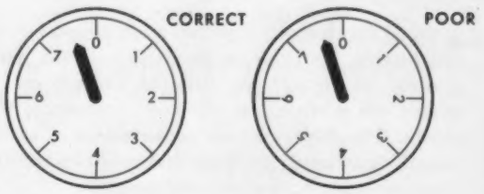
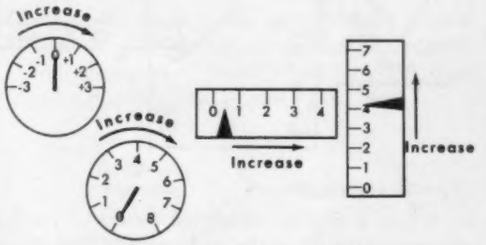


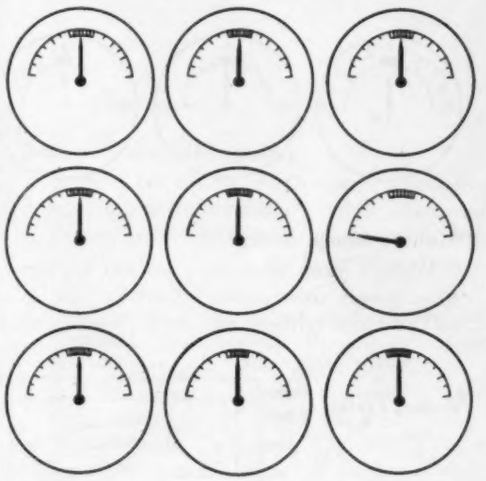
Direction of Pointer Movement

Scale progressions should be arranged so that a clockwise movement of the pointer indicates increasing values. For horizontal scales, left to right movement of the pointer should reveal increasing values. On vertical scales, bottom to top pointer motion should indicate increasing values.



Multiple Meter Displays

When groups of functionally related meters are arrayed in the same console area, check reading of meters can be facilitated by placing "zones" in the same location on each meter. The within-tolerance band should be at the 12 o'clock position, although for extended scales, the nine or three positions are suitable.

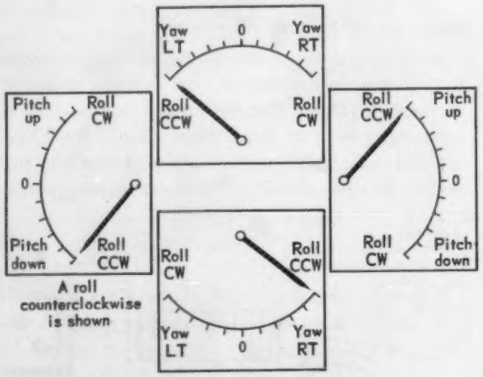


Symbolic Displays

In certain special applications, meters can be

(Continued on next page)

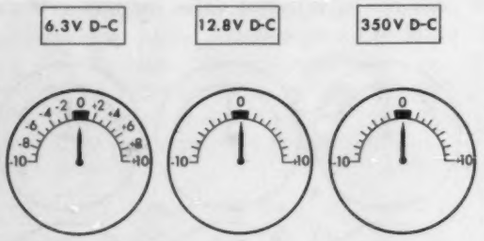
grouped for symbolic representation of subsystem functioning. For example, movement of four "jetavators" which provide direction changes on a missile are grouped on checkout equipment as shown. The display allows measurement of individual "jetavator" motions and provides easily discernible pitch, yaw and roll patterns.



A roll counterclockwise is shown

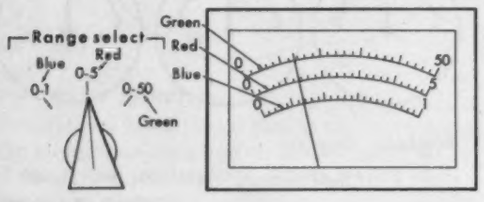
Zero-Deviation Meters

Where a number of related meters of varying ranges is arrayed on the same console, zero deviation meters can facilitate interpolation and decision making. By reducing all deviations from normal values to percentages, a constant frame of reference is maintained regardless of the original values. Evaluation of marginal conditions also is simplified.



Multiple-Range Meters

When a meter serves as a readout for two or more ranges, color coding should be used to associate range selected and correct meter scale.



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Whether you need a tapping screw that's coated to seal out moisture . . . a spinlock screw that vibration can't budge . . . a hose-clamp screw in carbon steel or stainless—call on National Lock. Utilize our design-engineering service to solve your fastener problem at lowest cost.
National Lock's diverse production capacity is geared to satisfy all your standard and special-purpose screw requirements. Fasteners to your exact specifications . . . delivered when you need them . . . in the quantities you require. Write us.

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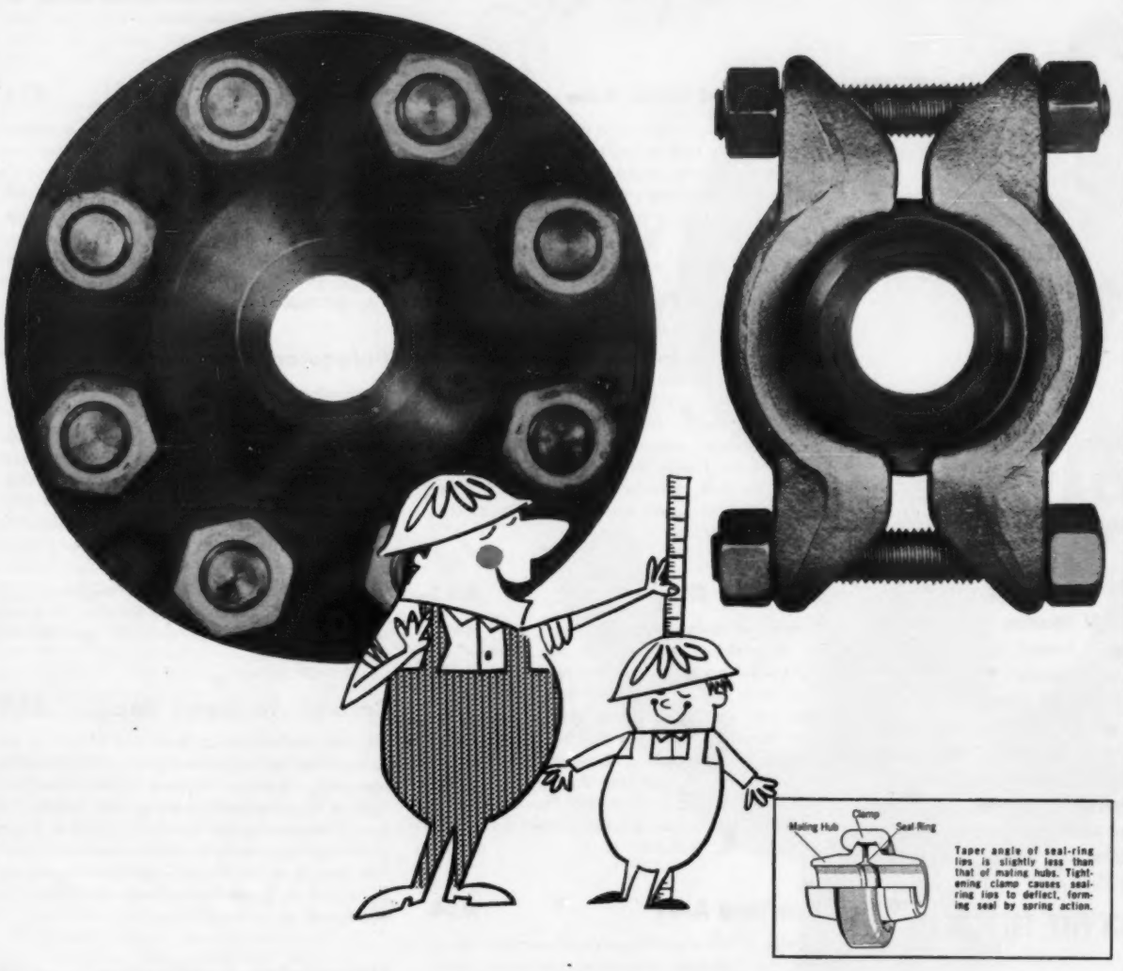
Grayloc Pipe Connections Save ⅓ the Space


Mating Hub
Clamp
Seal Ring
Taper angle of seal-ring lips is slightly less than that of mating hubs. Tightening clamp causes seal-ring lips to deflect, forming seal by spring action.

GRAYLOC® pipe connections are up to one-third smaller than flanged connections with comparable maximum pressure ratings. They save wasted space—cut unit weight and assembly time drastically.

An all steel assembly, GRAYLOC employs a pressure aided seal that can be assembled or disconnected in minutes. The heart of the assembly—the seal ring—is completely reusable.

Although GRAYLOC connections are manufactured in standard stock sizes from 1″ to 30″, special sizes for special applications are available on request. Corrosion resistant metals can be provided on short notice.

You can use GRAYLOC connections in your piping system. They'll save you maintenance and assembly time, space and money. To learn how, write for the new GRAYLOC catalog.

GRAYLOC SALES DIVISION

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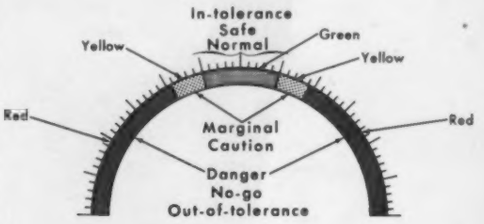
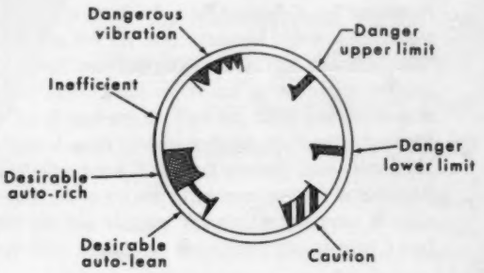
Color Zoning Meters

When within-tolerance and out-of-tolerance values for a function are well established, meter scales should be color-zoned. Green is ordinarily used to denote safe or normal functioning and red is conventional for danger or out-of-tolerance values. Where marginal conditions can be specified, yellow bands may be used.



Shape-Coded Meter Zones

Shape-coded meter zones are valuable for identification of varying conditions. Shape-coded bands are especially useful where low-level illumination operating conditions exist.



Reference and Bibliography

1. C. A. Baker and W. F. Grether, "Visual Presentation of Information", WADC Technical Report 54-160, Wright Air Development Center, Wright-Patterson Air Force Base, Dayton, Ohio, Sept. 1956.
2. A. Chapanis, W. R. Garner and C. T. Morgan, "Applied Experimental Psychology", John Wiley & Sons, Inc., New York, 1949.
3. E. J. McCormack, "Human Engineering", McGraw-Hill Book Co., New York, 1957.
4. W. E. Woodson, "Human Engineering Guide for Equipment Designers", University of Calif. Press, Berkeley, Calif., 1954.

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For overcurrent protection that fits hand-in-glove with tight operating specs, try the Heinemann Type C Overload Relay. You can practically design it yourself, to your particular requirements. And at reasonable cost. You not only can specify the exact integral or fractional continuous-duty current rating you need (between 0.02 and 60 amps), you can spec response characteristics, too. Within broad overall limits, you can have the precise time-delay-vs-overload action you want. All you have to tell us is the time within which actuation must occur at any specified overload value. In most cases, this value can be as low as 115% rated load. (Because the Type C is magnetically actuated, the calibrated trip points you select will remain constant for the life of the relay—no ambient-temperature compensation is necessary.) ■ Optionally available with trip indication and lock-out features, the Type C Relay is fully described in our Bulletin 5103. Write for a copy.

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NEW LITERATURE

To obtain copies of numbered literature . . . circle appropriate number on Reader-Service card.

Tool Steel Slide Rule 451

A slide-rule price estimator and weight calculator for use by tooling engineers, toolmakers and purchasing agents. Weight and prices of high-speed steels, die steels and regular tool steels can be determined at a glance. Latrobe Steel Co., Latrobe, Pa.

Tables and Formulas 452

Contains tables of weights and measures, math symbols and constants, the Greek alphabet, temperature conversions, binary numbers, powers of numbers, electrical formulas, the fundamentals of Boolean algebra and other useful information for the scientist and engineer. Circular 1985, 32 pages, is the fourth in a series of booklets designed to save time by providing engineering information in handy form. Automatic Electric Co., Northlake, Ill.

Drafting Film 453

Results of more than two years' rigid testing of "Herculene" drafting film are given in an eight-page brochure. Strength, erasure, reproduction, stain and durability of the polyester-based film and a report on how the surface of the film "takes" pencil, type and ink are included. Application information of the drafting film for washable and nonwashable tracings and a brief history of the film from 1952 to the present complete the booklet. Keuffel & Essex Co., Third & Adams St., Hoboken, N. J.

Drafting Aids 454

Catalog G contains 120 pages of essential equipment for engineers, draftsmen, contractors, architects, designers, surveyors, graphic artists, engravers, navigators, craftsmen, instructors and students. A 12-page price list in the center section of the book gives prices for all items by page and catalog number. Abbreviations and "how to order" are explained. Among items illustrated are drawing and engineering instruments, designing aids, surveying and measuring devices. Alvin & Co., Windsor, Conn.

Glass and Glass-Ceramics 455

A 68-page revised edition of "This Is Glass" is a comprehensive story of glass and glass-ceramics. The illustrated booklet reviews the history of glass and details the basic types of glass and its expanding role in science, industry, electronics, lighting and the home. One section introduces new glass-ceramic materials, trademarked "Pyroceram" and a two-page chart gives properties of selected glasses and glass-ceramics. A preview of the future of glass and glass-ceramics describes the extensive research being done with these basic engineering materials. Corning Glass Works, Corning, N. Y.

Silicone-Rubber Seals 456

Technical design information and cross-section drawings of standard silicone, fluorosilicone and fluorocarbon rubber seal constructions. Seals shown in Catalog No. 1, 42 pages, provide flexibility at —100 to 500F, immunity to ozone, weathering and shelf aging, and freedom from binding or corrosive action in contact with metals. The Connecticut Hard Rubber Co., 407 East St., New Haven 9, Conn.

Polyester Stock 457

A sample of translucent, rigid, glass-fiber-reinforced polyester stock. The 5- by 8-inch "Patnel" sample, showing several types of "custom communication" which can be formed as an integral part of the material, is packaged in an envelope that provides complete technical data. The communication contained within the material is integral with its matter; it is not surface-printed nor does it use natural embedment or lamination. "Patnel" is custom-made and formulated to meet specific requirements for size, thickness, rigidity and other physical properties. Kemlite Corp., Joliet, Ill.

Ceramic-to-Metal Seals 458

"How Ceramic-to-Metal Seals Are Made" is the title of this four-page Data Sheet 0500. Information of the ceramic, selection of the metal, design of ceramic-to-metal seals, how ceramic is metallized, plating the metallized ceramic, stable glazes and brazing is included. Thermal expansion characteristics of the ceramic and metal are illustrated in graph form. Coors Porcelain Co., 600 Ninth St., Golden, Colo.

Electric-Eye Application 459

A roundup of the history and development of electric eyes. A wide range of illustrations and schematics shows diversified photoelectric systems. Bulletin No. 611, 22 pages, is intended as a complete "answer book" to problems of automation—design, process or manufacturing—to help the engineer solve specific problems. The reference manual of photoelectric controls covers a period of 30 years' experience. Photomation, Inc., 96 S. Washington Ave., Bergenfield, N. J.

Tool Steel Trends 460

The first issue of "Tool Steel Trends", to be published every three or four months, contains basic information on the use, application and fabrication of tool steel. News of the industry, technical articles, material selection and production practices on heat treating, grinding and shaping will be found in this and future issues. Committee of Tool Steel Producers, American Iron and Steel Institute, 150 E. 42nd St., New York 17, N. Y.

Performance Curves 461

Catalog section No. C101 gives performance curves for more than 80 models of industrial pumps. These 36 pages of curves and calculations include information on "How to Interpret and Use Performance Curves" and seven family curves showing performance relationship between models of a given series. Roy E. Roth Co., Turbine Pump Div., Rock Island, Ill.

Exploded Views 462

A brief glimpse at the way in which exploded views are prepared, some of the uses to which they are put and examples of typical exploded view artwork. This 24-page brochure shows the difference in the way in which exploded views were prepared in the past and present method as well as the difference between isometric schematics and exploded views. The Mischka Co., Inc., 1511 Brookpark Rd., Cleveland 9, Ohio.

Silicone Coatings 463

A 16-page illustrated bulletin includes a description of a complete line of silicone coatings for release paper. Entitled "Silicones for Release Paper Coatings", the data describe three emulsions, four solvent solutions and two controlled-release additives for application from solvent. Technical information is given on the use of additives and descriptions of techniques for application and evaluation of silicone release coatings as well as tips on the care of equipment used to apply the coatings. Bulletin S-11 describes seven new products added to the silicone release paper coating line. General Electric Co., Silicone Products Dept., Waterford, N. Y.

Spring Design 464

A 16-page manual gives engineers and purchasing executives authoritative information needed to specify custom-designed and standardized precision springs. The literature summarizes basic information concerning helical springs, flat springs, wire forms, special fasteners, precision metal stampings and assembled spring-like devices. It emphasizes designing for performance, accurate material selection and quality-control measures that will result in parts that meet the specifications of the user. Included are design briefs which simplify the specifying of compression, extension, torsion and flat springs. Tables provide mechanical properties and recommended uses of commonly used spring materials and cold-rolled spring steels. Associated Spring Corp., Bristol, Conn.

Circle 73 on Reader-Service Card

The LGP-30 Electronic Computer is designed to stop the juggling of figures —and start the creating of profits.

The Royal Precision LGP-30 can solve routine and theoretical mathematical problems 30 times faster than any man—yet rents for little more than the salary of an additional engineer.

It is simple to program and operate, so no special programmer is needed. An engineer can use it himself. It requires no air-conditioning or costly installation. It plugs into any 110-volt AC wall outlet. It is mobile, so it rolls anywhere. It is desk-size, so it requires little room.

This means that the Royal Precision LGP-30 is ready to go to work to help your company create new products—and fresh profits—the very same day it is delivered. Can you wonder that there are more LGP-30's installed and working right this minute than any other electronic computing system in its class?

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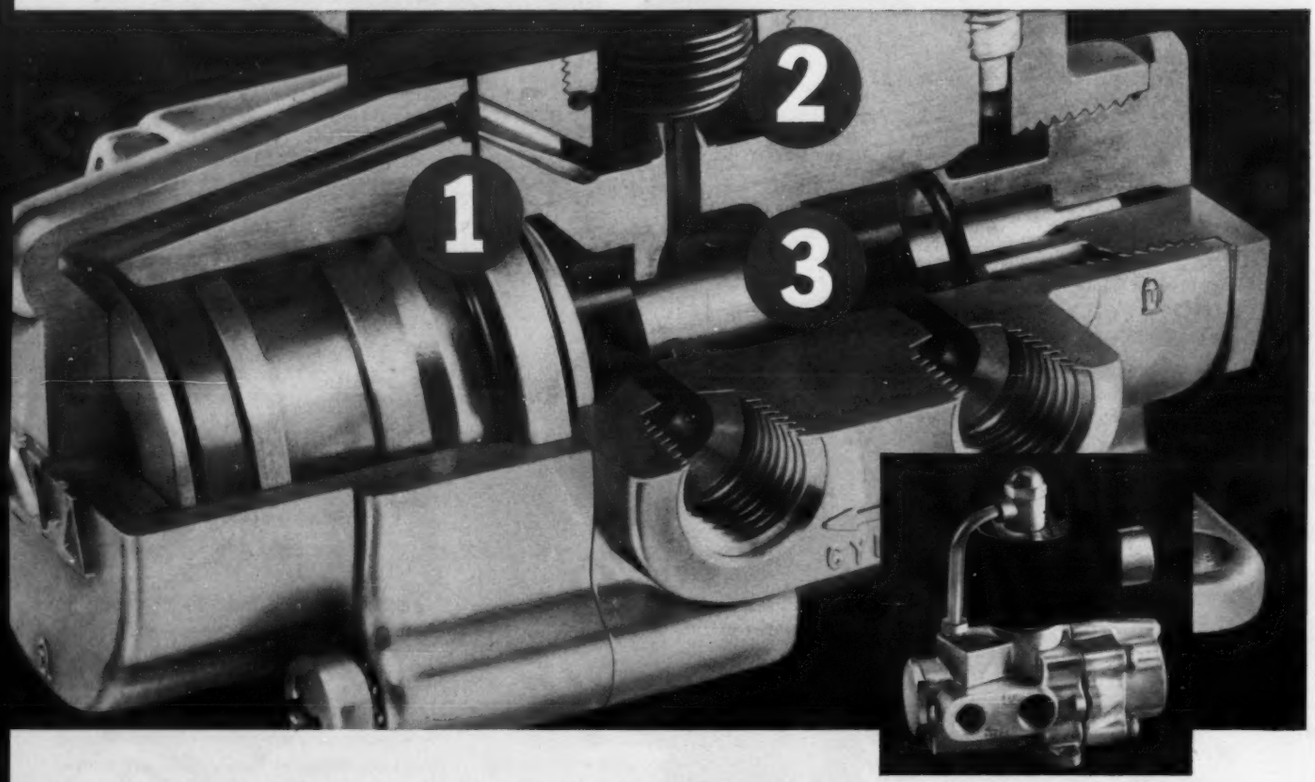

NEW LOW-COST ASCO 4-WAY SOLENOID VALVES HAVE BEEN CYCLED MILLIONS OF OPERATIONS WITHOUT FAILURE

1. **TIGHT SEATING** with unique patented poppet-type seats—Patent Nos. 2,624,565—2,775,982
2. **RELIABLE OPERATION ASSURED**—failure to return due to residual magnetism is eliminated
3. **POWER OPERATION IN BOTH DIRECTIONS**—main valve not dependent upon return springs

Installation is simplified; the 8344 may be mounted in any position!

Poppet seals and a unique combination of metal-to-metal with resilient seating enable these and other ASCO 4-way solenoid valves to provide dead-tight shut-off, even on air, without lapping, grinding or close adjustments. The utter simplicity of design, eliminating return springs and power-operating the main valve in both directions, assures unprecedentedly reliable performance without maintenance for indefinite periods.

The new ASCO Bulletin 8344 valve is the latest embodiment of over half a century's design and development experience. Its low cost makes it economical even as a 3-way valve, with one pipe connection plugged.

Here are the pertinent statistics:

Pipe Size	Catalog No.	Solenoid Enclosures	List Prices†	Operating Information
¼"	83440	Std.	$48.00	Pressures: to 250 psi.
¼"	83444	Expl. proof	56.00	Temp: to 212° F.
⅜"	83441	Std.	48.00	Fluids: air, water, hydraulic oil
⅜"	83445	Expl. proof	56.00	

† Subject to trade and quantity discounts.

Other ASCO 4-way valves come in pipe sizes from ¼" to 1½" for pressures to 500 p.s.i. For complete information write for Catalog 202, and see the hundreds of types of 2, 3, and 4-way solenoid valves available for immediate delivery from the world's largest stock.

ASCO Valves ASCO

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LITERATURE

Soldering Irons 465

Catalog 1-100-61 describes the new "Imperial" line of soldering irons with "Perma-Cool" handles. Interchangeable cord sets, standard or grounded, long-life heat cartridges and interchangeable thread-on soldering tips are illustrated. Catalog numbers and prices are given for each item. Ungar Electric Tools, Electronic Div. of Eldon Industries, Inc., 1475 E. El Segundo Blvd., Hawthorne, Calif.

Torque Synchros 466

Rapid selection of Size 23, 60-cycle synchros for servo applications. Data Sheet CS/TS-6-23-1 provides more than 25 vital characteristics for transformers, transmitters, differential and receiver transmitters, engineered and manufactured to MIL-S-20708A specifications. Schematic drawings, wiring diagrams and terminal designations complete the two-page sheet. Vernitron Corp., 125 Old Country Rd., Carle Place, Long Island, N. Y.

Selective Plating 467

Varied engineering applications of a new, high-speed selective plating process. In addition to discussing problems solved by the method, Bulletin I, eight pages, lists available equipment, techniques and results achieved. It also has a one-page question-and-answer section for a quick, overall idea of process capabilities. The process uses a special rectifier, metallo-organic solutions and a variety of styli to achieve dense deposits of almost any metal on any base metal. Selectrons, Ltd., 520 Fifth Ave., New York 36, N. Y.

Piezoelectricity 468

Application of piezoelectric devices and new developments in high-power handling abilities of the materials. The 16-page booklet, designed to show the principal existing and potential uses of piezoelectricity, outlines and compares performance characteristics of all major piezoelectric substances. Text and tables cover piezoelectricity as applied to convert mechanical energy to electrical energy and the reverse. Electromechanical properties and useful service temperature ranges of piezoelectric elements are included. Clevite Electronic Components, Bedford, Ohio.

Circle 74 on Reader-Service Card

Mixing Valve 469

Mixing valves in the 21300 series are described in Data Bulletin No. 8. The valve is used as a component in a missile pressure- and temperature-control system. Complete performance specifications are included in this one-page data sheet. Aerodyne Controls Corp., 90 Gazza Blvd., Farmingdale, N. Y.

Ceramic Property Chart 470

Chart No. 611 presents properties of the more frequently used AISIMag compositions. Selection tables show property values and thermal expansion. Dielectric strength and volume resistivity curves help make this chart a valuable tool for any engineer using ceramics. American Lava Corp., Manufacturers Rd., Chattanooga 5, Tenn.

Silicon Rectifier Assemblies 471

Specifications on silicon high-voltage potted rectifier assemblies. The six-page brochure, ECG 487, includes information on how to select a potted rectifier assembly and detailed specifications on various rectifier circuits requiring multiple potted blocks. Five charts show performance of the potted assemblies under various operating conditions. General Electric Co., Rectifier Components Dept., Auburn, N. Y.

Power Tools 472

A consumer line of power tools and accessories is fully described in a 500 Line catalog. Eleven new tools, out of a total of 19 listed, are a compact ½-inch drill, three "Skilsaws", a jig saw, ¼-inch drill and power unit, ¼-inch drill kit, ⅜-inch drill, orbital sander, shrub and grass shears, and hedge trimmer. Skil Corp., 5033 Elston Ave., Chicago 30, Ill.

A-C Motors 473

Bulletin B-2515, 16 pages, shows a complete line of a-c motors from 1 to 2000 hp. Product features of each motor are outlined and explained for easy selection of the right motor for every application. A detailed description is given of the production facilities and procedures used to manufacture the motors. Reliance Electric and Engineering Co., Cleveland 17, Ohio.

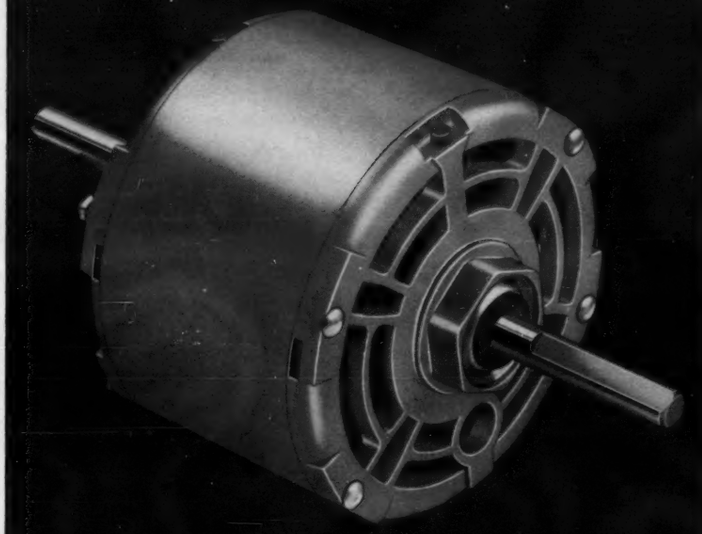
Self-Locking Fasteners 474

The largest, most complete selection of lightweight, all-metal, self-locking nuts every developed for the airframe, propulsion and electronic industries is detailed in this 1961 catalog. A line of floating and non-floating stake-nuts in regular and miniature sizes and a line of high-strength, thin wall inserts are included. Kaylock Div., Kaynar Mfg. Co., Inc., Box 2001, Terminal Annex, Los Angeles 54, Calif.

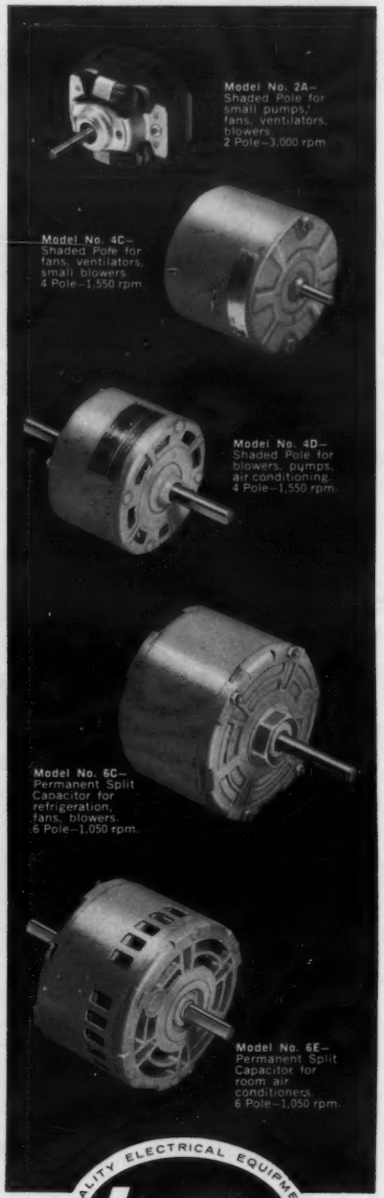
Silicones 475

A complete line of silicones and their uses are described in Catalog CDS-12C. The literature contains photos and data pertaining to silicone products and a complete selector guide for silicone rubber. The eight-page catalog is broken down into four general categories dealing with silicone fluids, silicone protective coatings, silicone electrical insulation and silicone rubber. Products are grouped wherever possible under appropriate end-use headings. General Electric Co., Silicone Products Dept., Waterford, N. Y.

SPECIFY LEECE-NEVILLE MOTORS FOR QUALITY, RUGGED DESIGN, LONG LIFE



ECONOMY AND RUGGED STRENGTH—Model 6D Shaded Pole. 6 Pole —1050 rpm—1/12 to 1/4 hp. Quiet, smooth running power... ideal for air conditioning, refrigeration and heating service.


Model No. 2A—
Shaded Pole for small pumps, fans, ventilators, blowers.
2 Pole—3,000 rpm.
Model No. 4C—
Shaded Pole for fans, ventilators, small blowers.
4 Pole—1,550 rpm.
Model No. 4D—
Shaded Pole for blowers, pumps, air conditioning.
4 Pole—1,550 rpm.
Model No. 6C—
Permanent Split Capacitor for refrigeration, fans, blowers.
6 Pole—1,050 rpm.
Model No. 6E—
Permanent Split Capacitor for room air conditioners.
6 Pole—1,050 rpm.

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The Leece-Neville Company, Dept. DN-5
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*Name*_____ *Title*_____

*Company*_____

*Address*_____

*City*_____ *Zone*___ *State*____

*Type of product*_____

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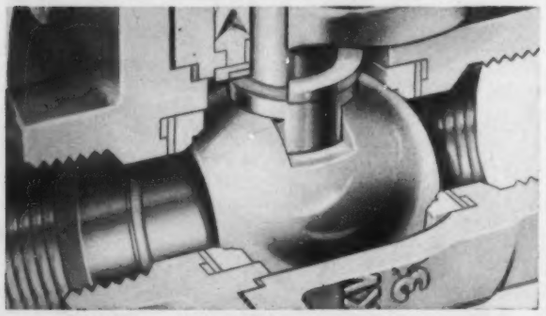
IN ROCKWOOD BALL VALVES



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Rubber outperforms all other materials. It is tough, abrasion-resistant . . . seals tighter, longer. Teflon is used only for corrosion and high temperature resistance.

Whether Teflon or rubber is used, *Rockwood Ball Valves* are best for all applications. Rockwood Ball Valves have larger waterways per valve size, a wider choice of valve types and the most durable construction.

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ROCKWOOD

BALL VALVES

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ACE is one of America's leading mass producers of plastic extrusions and all types of precision parts. Any shape, form or color. Any type of plastic. Small runs or large runs. Huge stocks for immediate delivery. Quick, low-cost service on specials. Write, wire or call for samples, price lists and technical bulletins.

SINCE 1934 A EXTRUDERS FABRICATORS

ACE PLASTIC COMPANY 91-26 VAN WYCK EXPWY • JAMAICA 35, N. Y.

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Photographic Technique for Measuring High Surface Temperatures

J. H. Siviter, Jr., and H. K. Strass,
Langley Research Center, Langley Field, Va.

This analysis presents an improved method of using a calibrated photographic emulsion to determine elevated temperatures of surfaces. Calibration curves are given for a temperature range of 1400 to 3600F.

Nomenclature:

E	relative exposure, $\frac{I_o}{I} t$ or	$\varepsilon \frac{t_e}{f^2}$, sec
f	lens aperture setting	
I	transmitted light intensity, watts-meter^{-2}	
I_o	incident light intensity, watts-meter^{-2}	
T	temperature, deg F, abs	
t	time, sec	
ε	surface emissivity	
λ	wavelength, microns	

Subscripts:

e	exposure
T	surface temperature

A study was first made of film density, exposure and body temperature to determine whether calibration curves might be predicted for a particular type of film. It was necessary to consider both the film properties and the properties of body radiation.

Fig. 1 illustrates the spectral distribution of radiation from a black body at several different temperatures. The portion of the spectrum representing visible radiation is identified by the

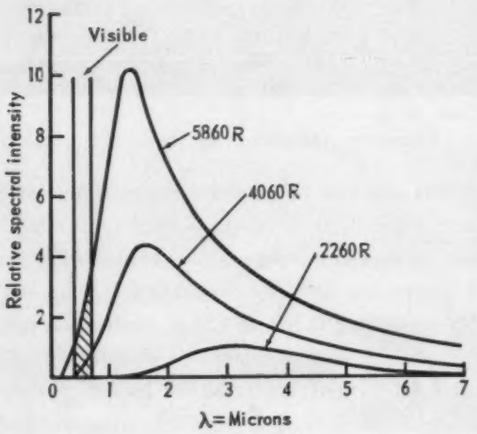

Fig. 1

CERROTECHNICS saves TIME • LABOR • MONEY

in spinning re-entrant shapes

CERROTECHNICS is the practice of using low-temperature-melting CERRO* ALLOYS to expedite many industrial operations.

*T. M. Cerro Corporation

For instance: the chuck over which this aluminum pitcher was spun was made of CERROBASE. After spinning, the pitcher is inverted in an oven over a container that catches the molten alloy for re-use. **Write for further information.**

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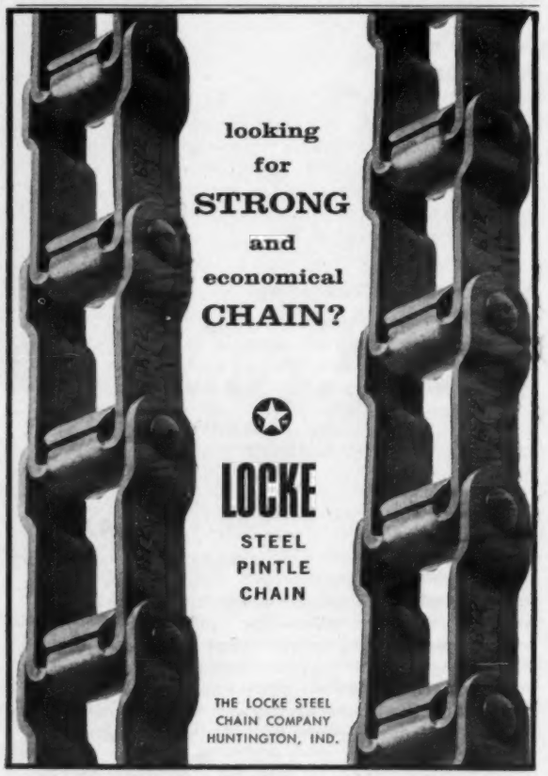

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THOMSON "Snap-In" NYLINERS
—BEARINGS of smooth, tough DuPont NYLON

COST less to BUY
...less to INSTALL
ELIMINATE LUBRICATION!

Additional Benefits:

- CLOSE FIT
- LONGER LIFE
- EASILY INSTALLED
- LESS SERVICING
- SELF-RETAINING
- RESIST CORROSION
- LOW FRICTION
- RESIST POUNDOUT
- NO FRICTION OXIDATION
- DAMP VIBRATION
- OPERATE IN LIQUIDS
- NON-CONTAMINATING
- INSTANTLY REPLACEABLE
- RESIST ABRASION
- MINIMUM SPACE
- SILENT OPERATION
- LIGHTEST WEIGHT
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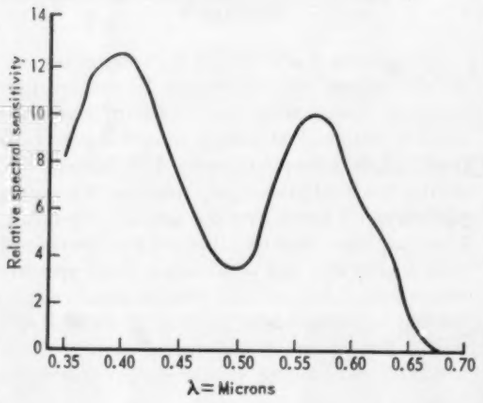


Fig. 2

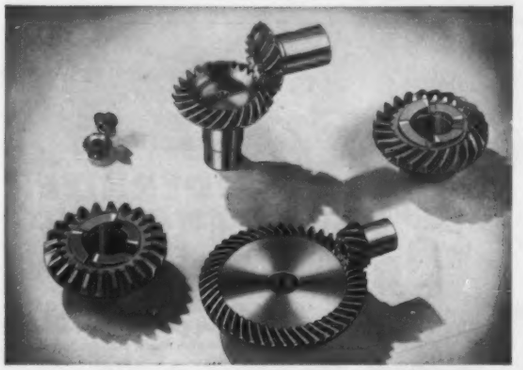
hatched area. The hatched area is also representative of the part of the spectrum to which the film is sensitive and shows the relative energy emitted by a black body in the film spectrum.

Relative energy change with body temperature in the visible spectrum varies between T^{11} and T^{14} for black-body absolute temperature below 3000F. The exponent in the energy relation decreases with increasing body temperature. The large exponential value of temperature is attributed to rapidly varying energy level with temperature in the visible spectrum, and this variance contributes greatly to the accuracy of the photographic technique.

The exposure constant of the photographic emulsion is essentially the integrated area under the spectral-sensitivity curve shown in Fig. 2 for Kodak Tri-X Pan Film. If spectral sensitivity of the emulsion were uniform with wavelength, response of the film to visible radiation would be the same as the energy change with wavelength in the visible spectrum. Unfortunately, the spectral sensitivity is not uniform, but varies with wavelength as shown in Fig. 2.

Therefore, calculation of the film response is weighted according to the variation of the film sensitivity with wavelength. At a given black-body temperature, the ratio of film-sensitivity to energy-intensity is taken at a number of different wavelengths between the spectral limits of the film. Summation of the ratios at a given black-body temperature determines the relative response of the film at the given temperature. Calculations of this type are made for several black-body temperatures in order to determine the relative exposure variation required to obtain a constant density on the film.

(Continued on next page)



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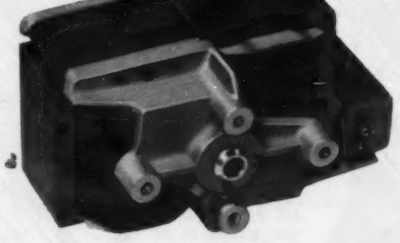

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Photographic Technique . . . Cont.

Apparatus

The camera is a modified K-24 aerial camera. A lens mount was constructed to employ four matched lenses; thus, four different exposures could be obtained on a single shutter action. Lens focal length is approximately 3.75 inches. The shutter is a focal-plane type consisting of a slotted curtain which passes over the film at a fixed rate. Exact exposure time for all lenses was determined with a photocell and oscilloscope. Lens aperture ranges from f/3.75 to f/22. Smaller effective apertures were obtained by placing additional calibrated diaphragms at the optical center of the lens and by placing neutral-density filters in front of the lens.

Two different facilities were used to produce known elevated surface temperatures of high emissivity for the purpose of experimentally calibrating the film. An "Inconel" plate, 1/16 by 1½ by 9 inches, was heated by its electrical resistance to produce temperatures up to 2000F. Initially, the strip was heated to 2000F for 15 minutes to obtain a stable oxide coating on the surface. Surface emissivity was approximately 0.7 to 0.8. The actual surface temperature was measured by thermocouples.

Induction-heated furnaces were used as a source of black-body radiation. These furnaces have temperature capabilities of 2400F and 4000F. In order to reduce error in film calibration, any background lighting was eliminated. In other cases where background lighting could not be eliminated, photographs were made to determine the intensity.

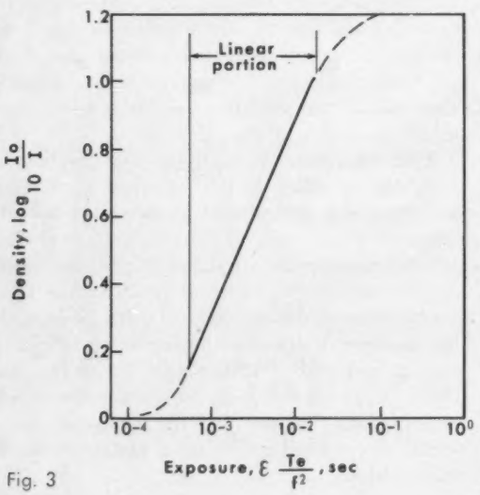
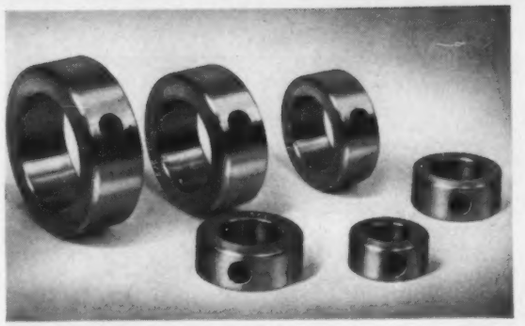


Fig. 3



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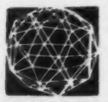

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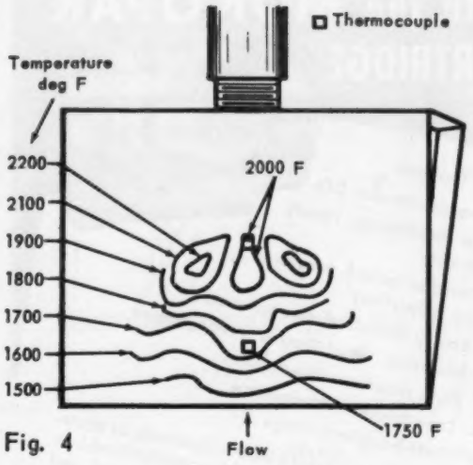

Fig. 4

The photographic film used in this investigation was processed in Kodak Microdol Developer. The developer was diluted with 1 qt of water to 1 gal of developer, and the developing time extended 5 minutes. Development time was increased to lessen the chance of error. A universal hardening fixer was used according to the manufacturer's recommendations.

Film density was measured with a densitometer. Images were magnified by projection approximately 8 to 10 diameters with a photographic enlarger to increase area resolution.

Kodak Tri-X Pan Film was used because speed of the film is relatively high and the spectral response covers the visible spectrum. A high-speed film was necessary since the surfaces to be photographed experienced a rapid temperature rise. An infrared film would be useful at the lower temperatures, but the lengthy exposures required by most infrared films could not be tolerated at the high temperatures of the present tests.

Calibration

An important fundamental characteristic of an emuslion to be considered is the variation of relative optical density $\log \frac{I_o}{I}$ with relative exposure $\epsilon \frac{t_e}{f^2}$. If the emulsion is exposed to visible radiation of constant intensity and the resulting film densities are plotted as a function of exposure time, the data will define a flattened S-shaped curve. A curve of this type for Kodak Tri-X Pan Film is illustrated in Fig. 3. For all practical purposes, the portion of the curve between the approximate densities of 0.1 to 1.0 can be taken as

(Continued on next page)

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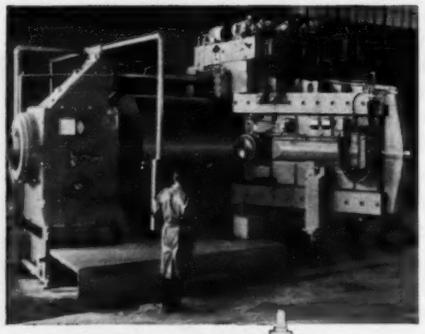

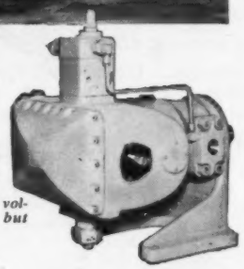

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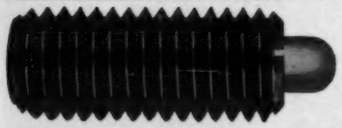

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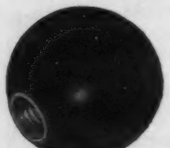

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a straight line. Only the linear portion of the curve is considered in this investigation.

A practical application of the photographic temperature-measuring technique is presented in Fig. 4. The surface of the 30-deg wedge contains a spherical bulge that might represent a surface configuration for a high-speed missile. The model was tested in a hot air jet at Mach 4 and a stagnation temperature of 2600F to determine the effects of the bulge on local aerodynamic heating. The original negative used to make the temperature measurements permitted a detailed temperature map to be made of the surface.

A tungsten-filament standard lamp of known temperature and emissivity was used as a temperature reference to calibrate the film. Also, a photograph was made of a constant-intensity neon lamp simultaneously with each photograph of the model of unknown intensity. This procedure would indicate any exposure changes in the camera shutter.

Air from the hot jet did not have sufficient energy in the visible spectrum to have any effect on the emulsion. The low reflectivity of the model surface prevented any appreciable reflection of the jet hot bed. Thus, no base density occurred on the emulsion for a cold model.

Several thermocouples were attached to the back surface of the spherical bulge. Fig. 5 shows a comparison of the surface temperature as determined by a thermocouple with that as determined by the photographic technique.

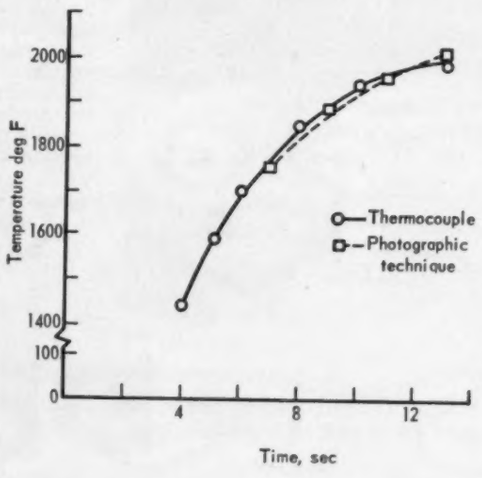

Fig. 5

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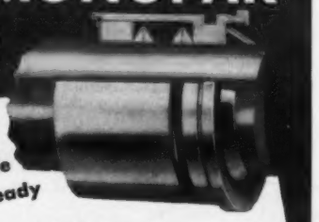

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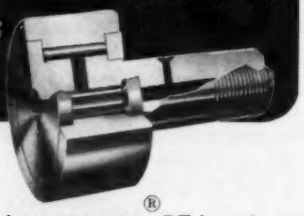

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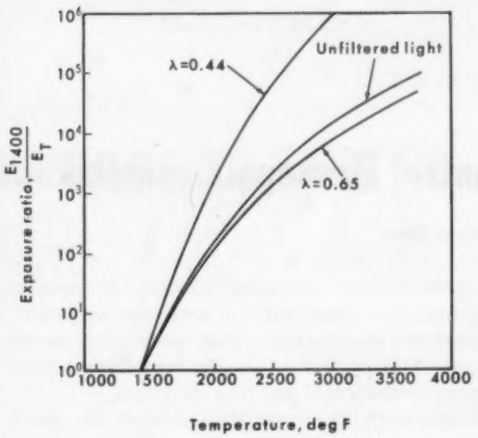

Fig. 6

Errors and Sensitivity

Certain conditions causing error in the temperature measurement should be considered. Error induced by uncertainties in surface emissivity is in the same order of magnitude as that experienced with the optical pyrometer. The effect of this error is reduced because of the large intensity change of radiation with temperature in the film spectrum. For example, an uncertainty of 25 percent in surface emissivity corresponds to an error of about ±35F at 1600F and about ±110F at 3000F.

The nonuniformity in the spectral sensitivity of the emulsion was found to have little effect on exposure variation.

Sensitivity of the calibration system would be affected by the slope of the exposure-ratio curve. Since the slope of the exposure-ratio curve is dependent upon the spectral nature of the radiation (other factors being constant), controlled changes in the incoming radiation could produce a desired effect.

A series of calculations was made of the exposure response with the assumption that the radiation would be filtered so as to transmit only monochromatic light. Wavelengths of 0.44 micron and 0.65 micron were selected, and the resultant data are given in Fig. 6. If only the shorter wavelengths are allowed to fall on the film, the slope of the exposure-ratio curve is increased. Thus, accuracy at the higher temperatures would be increased by use of filters passing monochromatic radiation at wavelengths of 0.44 micron.

Abstracted from a paper entitled "An Investigation of a Photographic Technique of Measuring High Surface Temperatures"; NASA TN D-617; National Aeronautics and Space Administration, 1520 H. St., NW., Washington 25, D. C.

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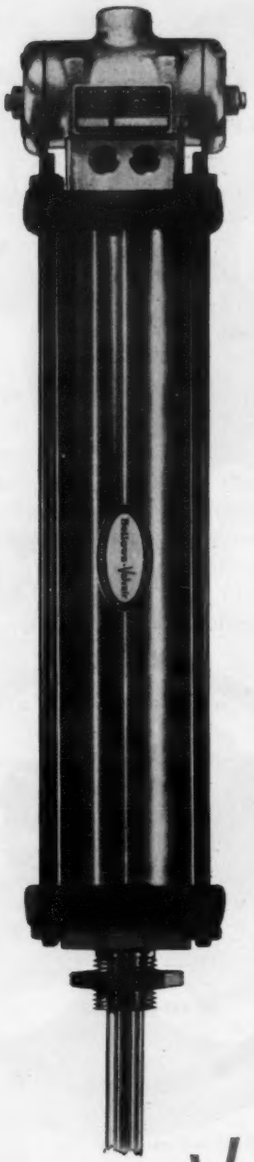

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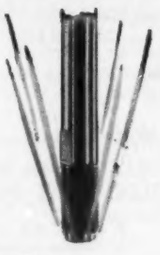

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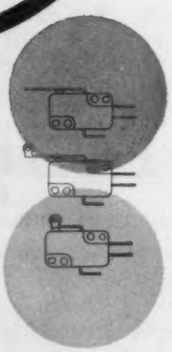

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Direction-Control Package Designed for

Lars G. Soderholm, Midwest Editor

A 10,000-psi manifolded, subplate-mounted, pilot-operated, four-way directional control valve uses ball check and poppet-type valves especially designed for high-pressure operation. Together with the ⅜-inch four-way valve which can be solenoid- or pilot-operated, it is possible to have a complete open-center circuit, a closed-center circuit or a closed center with venting option on the pump.

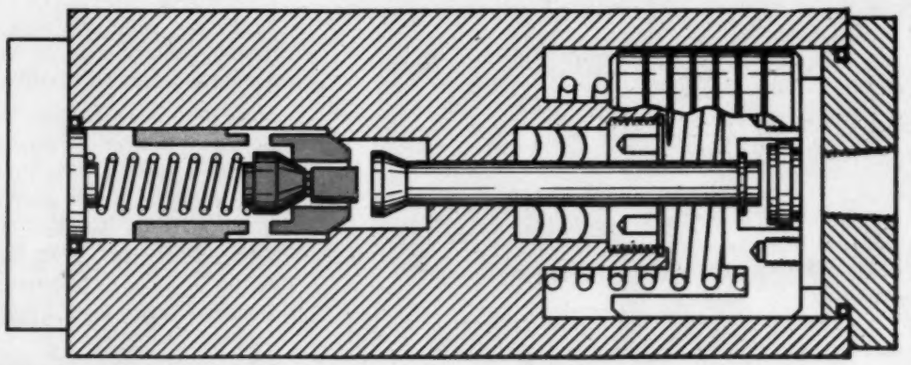
The primary design idea in the creation of this particular control package was to gather all the necessary valves on one manifold for the convenience of the customer using high-pressure pumps. This results in a neater installation and also reduces external leakage.

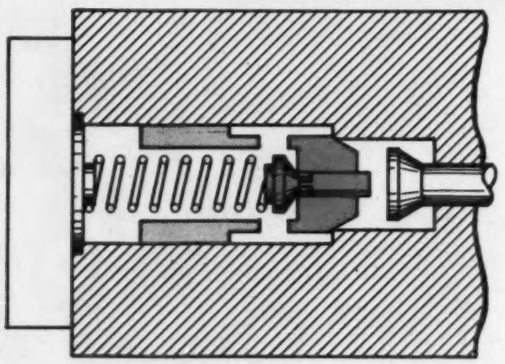
A high-pressure control package is more than a collection of valves. Because of energy buildup resulting from the compressibility of the oil and stresses within the machine frame and piping, the various components must withstand not only the pressure imposed upon them, but also they must be able to control the decompression and deceleration in the circuit. This is handled by the use of the proper poppet combination.

High-ratio poppets are able to open the circuit against pressure and allow controlled bleed-down until the valve fully opens at a lower pressure. A lower ratio poppet combination is used to get maximum conductance on the valves that oppose the pump on the manifold circuit.

Generally, where pressures over 6000 psi are encountered, copper gaskets are used in the valve components. O-ring seals are used in the control pressure portion of the valve.

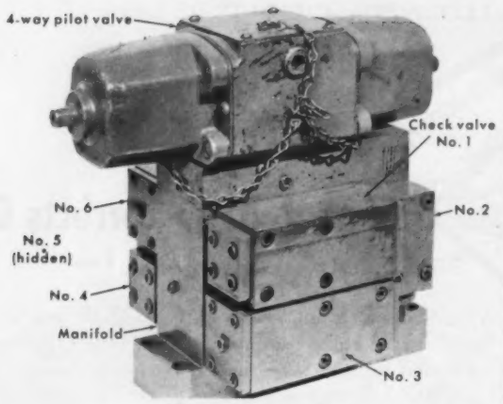
The high-pressure, four-way valve is made presently in a ⅜-inch size by Racine Hydraulics & Machinery, Inc., Racine, Wis.

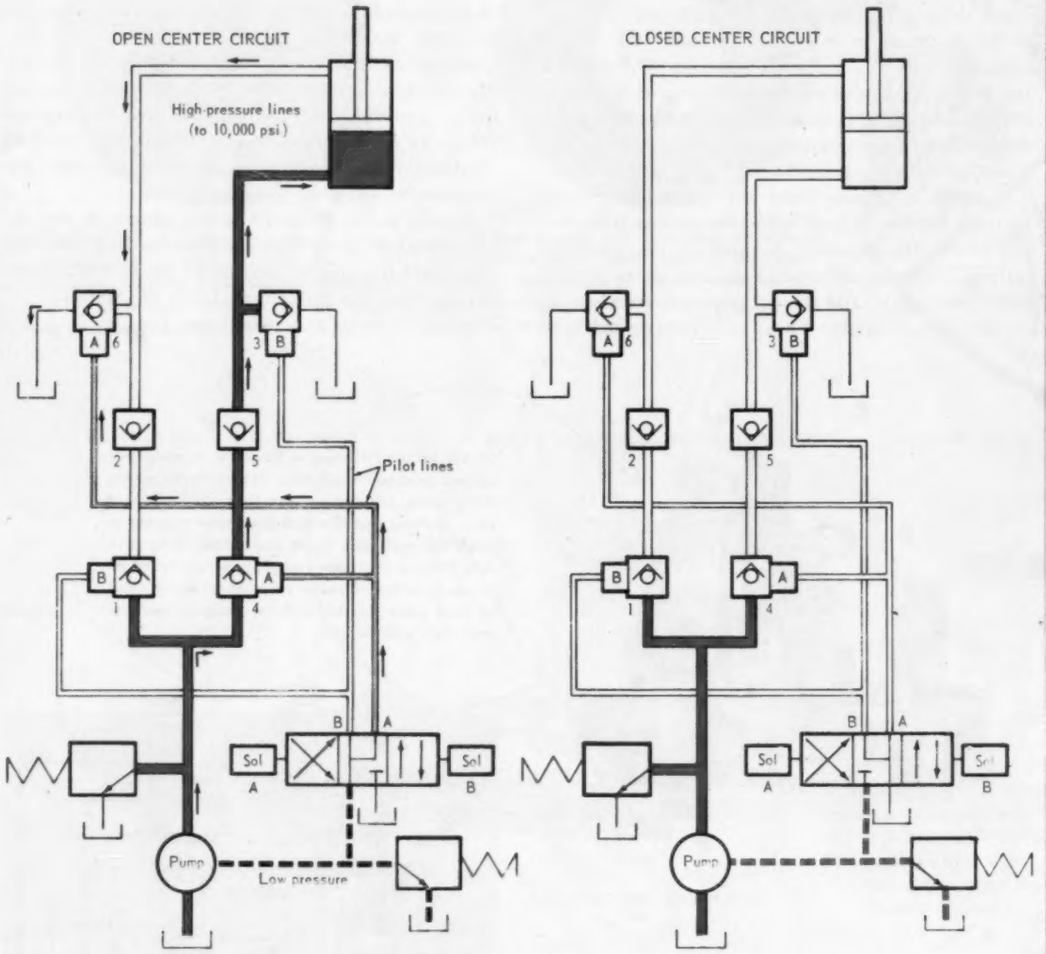




TWO POPPET COMBINATIONS are offered as standard on pilot-operated check valves. One combination uses ⅛-inch-dia poppet for decompression ratio of 130:1 on small poppet and opening ratio of 8:1 on main disc. Second combination uses ¼-inch-dia small poppet and again 8:1 ratio on main disc. Small and large poppets can be interchanged to produce ratios or flow-rate characteristics desired.

10,000-PSI Operation

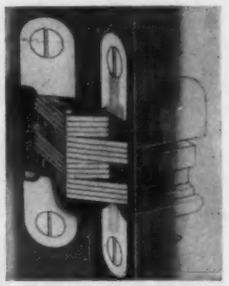




OPEN-CENTER CIRCUIT: In neutral position, pilot pressure is directed to all pilot-operated checks and pump. Both ends of cylinder are open to tank. Energizing solenoid A of four-way valve directs pilot pressure to check valves 4 and 6. Pilot line of valves 1 and 3 are open to drain. As cylinder advances, fluid returns to tank past valve 6. De-energizing solenoid A and energizing solenoid B reverse direction of cylinder since check-valve functions are now reversed. Check valves 2 and 5 prevent pressure in one cylinder line from relieving the other during decompression or flow reversal. **CLOSED-CENTER CIRCUIT:** In netural position all pilot-operated check valves are closed since pilot piston area is open to tank.

NEW INVISIBLE HINGES

General Purpose Hinge Creates Flush Surfaces



These hinges are completely hidden from view when door, lid or hood is closed. Makes possible flush, absolutely smooth surfaces that greatly enhance appearance and safety. Tapered body sections are precision castings of a special zinc base alloy having a tensile strength of 47,000 pounds per square inch. Operates in a 180 degree arc which permits full opening. Laminated link construction reduces friction and permits hinges to operate freely and smoothly. Hinges are reversible and may be used right or left hand. Available for wood or metal application in a wide variety of sizes.

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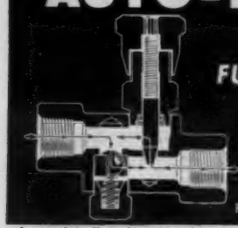

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Model KF Knob and Dial Flow Control Valve or Model KN Needle Valve.

Model PF Knob and Dial Flow Control Valve or Model PN Needle Valve for panel mounting.

Model C Check Valve for In-Line Mounting.

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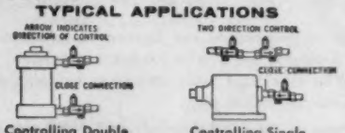

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Output Voltage Corrects Gear Hobber Transmission Errors

Ronald W. E. Martin, British Editor

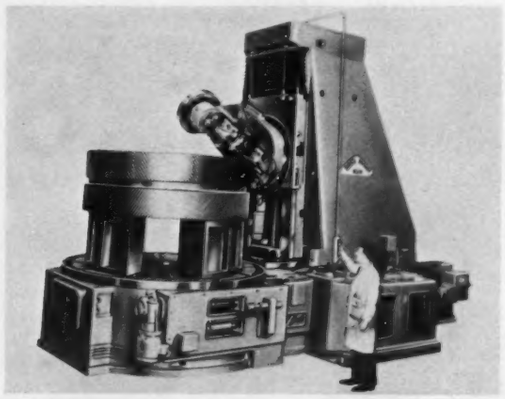
A control system embodied in a gear hobber continuously measures transmission errors and applies correction through a feedback servomechanism.

On the 3.5-meter machine, speed ratio from the worm drive shaft (input) to the work table (output) is 450:1. Errors in this drive produce lack of synchronism between input and output. The measuring system consists of a synchro-resolver driven from the input and an "Inductosyn" attached to the table center. A split-field motor, gear-box and special differential mechanism feed corrections to table drive.

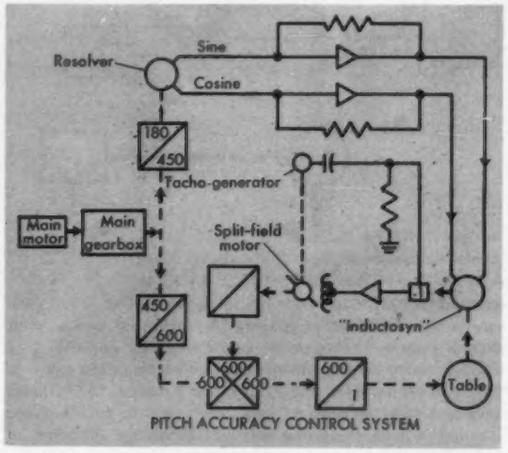
Resolver is driven from the worm drive shaft through a 450:180 gear reduction to match its output to the "Inductosyn". It produces two electrical outputs, one proportional to the sine of its original positioned angle, and the other proportional to the cosine of that angle. Thus, two voltages are produced whose amplitudes vary sinusoidally as the synchro rotates. The output produces one cycle for one complete turn of the resolver. These voltages are applied to buffer amplifiers which modify the impedance of the signals and apply them to the "Inductosyn" stator.

When resolver output voltages are applied to the "Inductosyn" stator, there is no output from the rotor, provided the "Inductosyn" and resolver are always in synchronism. If error exists, resolver and "Inductosyn" will not be in synchronism, and "Inductosyn" rotor gives a voltage output.

Known as the Emisyn Control System, it is a development of David Brown Industries, Ltd.; the "Inductosyn" is manufactured by E. M. I., Ltd., under license from the Inductosyn Corp. of America.



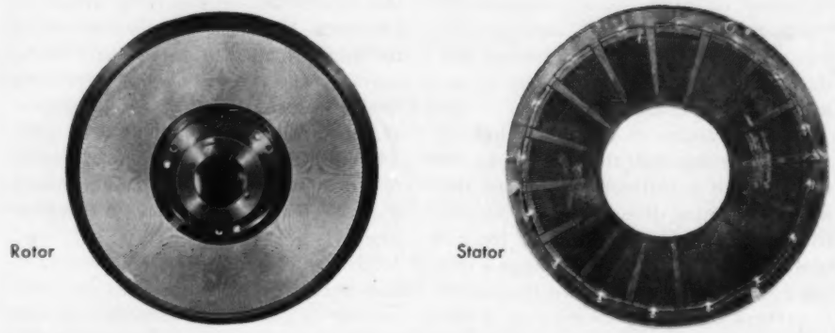
GEAR HOBBER consists basically of main motor and gear-box with three output shafts which drive work table, hob and hob saddle. Speed ratio of three shafts, which determine number of teeth cut and helix angle, is established in gear-box. Pitch and accuracy of gear cut are based on accuracy of transmission from worm drive shaft to work table. Control system measures and corrects this transmission.



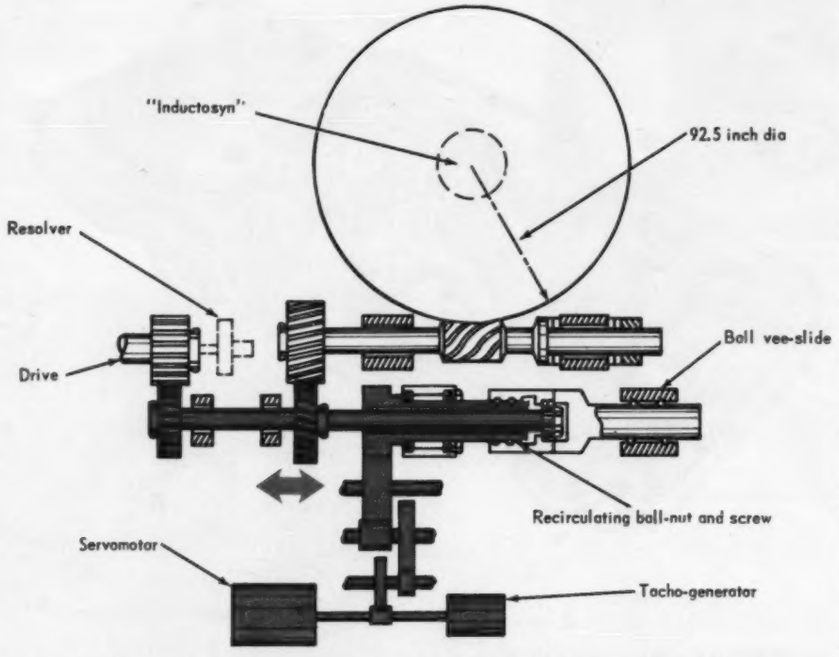
PITCH ACCURACY CONTROL SYSTEM

BLOCK DIAGRAM of pitch accuracy control system for continuously measuring transmission errors and applying correction through feedback servomechanism. Amplified in a balanced servo-amplifier, voltage energizes fields of split-field motor and rotates to correct error. Correction servo system is stabilized from d-c tacho-generator driven by servomotor.

through Servomechanism



MEASURING OF POSITION is effected by rotary "Inductosyn". It comprises two glass discs, one of which is attached to rotating table and other to machine base casting. Each disc has a winding photographically engraved on it. Windings of elements are continuous and in form of end-connected radial lines spaced 1 deg apart. Stationary element has 16 separate windings. Adjacent windings on stator are displaced relative to each other by ½ deg.



SERVO-CORRECTING MECHANISM slides one helical gear axially with respect to its mating gear. Layshaft has spur gear at one end mating with wide spur gear on main gearbox output shaft. Axial displacement is produced by frictionless, backlash-free, recirculating ball nut and screw. Layshaft extension is located in nut by duplex bearing; nut is restrained from rotating by ball V-slide. Mechanism is capable of correcting at rate of 0.0004 ips.

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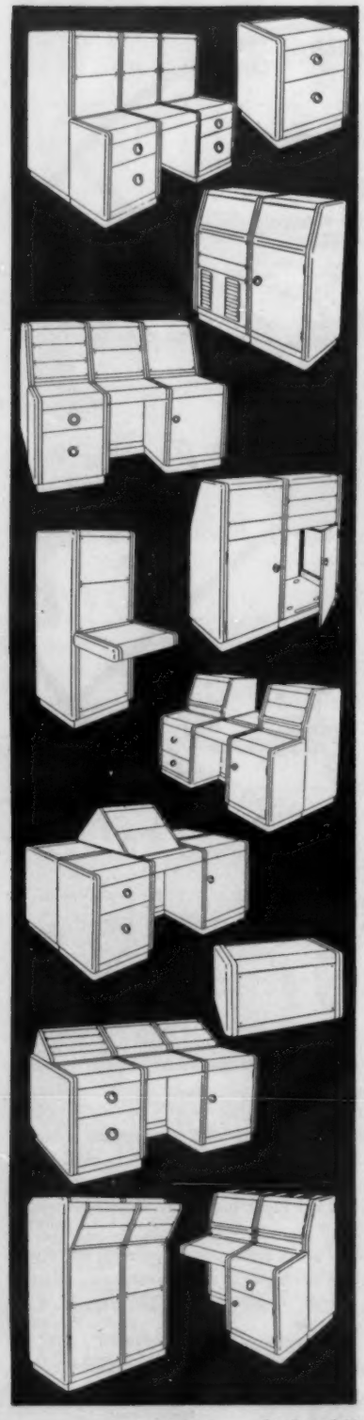

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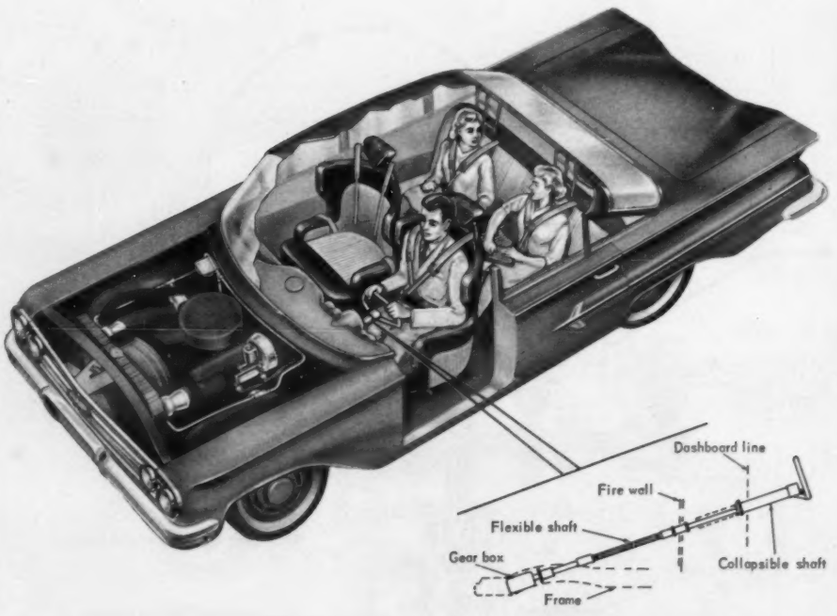
SCANNING PRESS RELEASES

• **"SURVIVAL CAR II"**, designed and sponsored by the Liberty Mutual Insurance Co., Boston, Mass., illustrates how the driver and passengers are afforded maximum protection against bodily injury caused by head-on, rear-end and side or lateral collisions. Basic principles of "packaging the passenger", incorporated into the redesign of the car's interior, are the result of more than eight years of research and experimentation.

Special features of the car include a flexible steering shaft that will buckle in the event of a collision to prevent the shaft from being driven into the driver's chest or abdomen. Car's steering mechanism will, during a crash, telescope a distance of eight inches into the dashboard to prevent face and body injuries. A rectangular-shaped steering wheel is provided to prevent breaking or bruising of driver's kneecap when assembly "telescopes. Whip-lash protection is afforded on all seats to retain head up to a force of 500 lb in the event of a rear-end collision.

Improved maneuverability, faster turning ability and greater driving stability are achieved through the utilization of this reduced-diameter steering wheel. An automatic fire control protection system has been provided to smother any fire in engine compartment. Complete braking safety is assured through the utilization of an in-the-line safety brake device. Essentially, this unit will allow operation of either the front or rear brakes should the other pair fail to respond to foot pressure.

Extra safeguards against body crushing and head injuries, caused by car overturning in a crash, are provided by roll-over bars installed in the capsule chairs. Laminated safety windshield with double-weight filler affords greater resistance to penetration.



COLLAPSIBLE STEERING ASSEMBLY

MODIFIED FOUR-DOOR SEDAN drawing shows two capsule chairs which have replaced car's conventional front seat. These chairs have sufficient strength to withstand a 5000-lb blow and a deceleration force of 30G likely to be caused by a 30-mph speed in a front, rear or lateral crash. Arm rests and wings of chairs give added protection to arms and shoulders of driver and front-seat passenger.

• **SANDWICH HONEYCOMB** construction panels, which characterize mobile home additions, portable classrooms and vacation cottages, proved to be the solution of a problem which threatened to delay one phase of our nation's space program.

Engineers on the Saturn Space Project at Cape Canaveral were stymied—not by the rocket itself, but by the service tower which is vital to preparing the rocket for flight.

A highly complicated piece of equipment, the huge, 310-ft, 28-story, structural-steel tower is actually two towers straddling the rocket, joined at the top with bridging. It is mounted on rails so that when rocket servicing is completed, tower can be moved out of launching range.

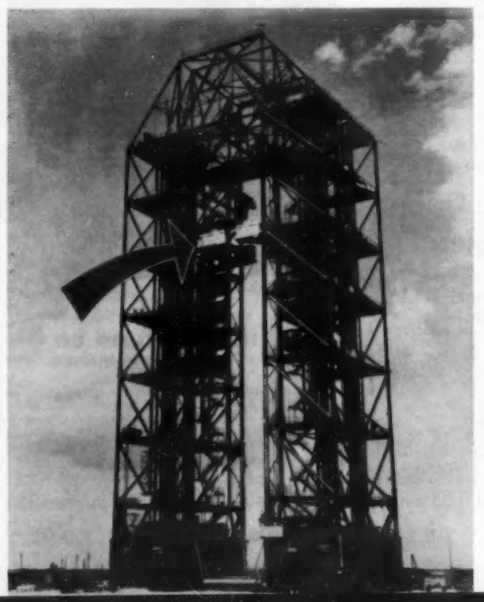
Each half of tower contains five service platforms, one above the other. Platform floors and roofs adjacent to the rocket have a 24-ft, semicircular cut which clears the rocket at all points, yet encases it so that every inch of the Saturn is accessible.

Plans also specified that the platforms be enclosed with a self-supporting structural roof and walls that could be disassembled easily. The sections had to be light in weight and well insulated.

It became apparent that a severe weight-versus-structural-strength problem loomed. Tests showed that the best combination of properties was offered in the aluminum honeycomb sandwich panel construction that was developed by Panelfab Products, Inc.

The secret of the superior panel lies in its honeycomb core. Before being expanded, the core is planed by a machine, which gives it a uniform thickness with less than 0.005-inch variance.

Maurice H. Connell & Associates, Inc., Miami, Fla., did the basic design for the Saturn Service Structure. Kaiser Steel Corp., the prime contractor, had final design responsibility.



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20-Millionths Bearing Tolerances – Maximum	INNER RING	OUTER RING
Roundness (Bore or O.D.)	.000020"	.000020"
Taper (Bore or O.D.)	.000020"	.000020"
Side Runout (with Bore or O.D.)	.000020"	.000020"
Raceway Roundness	.000020"	.000020"
Raceway Parallelism with Side	.000020"	.000020"
Radial Runout	.000020"	.000020"
Parallelism of Sides	.000020"	.000020"

.000020" TOLERANCE BEARINGS

To meet ICBM requirements, 14 ball bearing tolerances had to be reduced to 20 millionths of an inch—a 10-fold advance in the state of the art. Today "20-Millionths" ball bearings are in volume production at Barden—probably the most precise mechanical assemblies ever manufactured in quantity.

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EACH BEARING DOCUMENTED

All inner and outer rings are numbered serially, as are the bearings assembled from these parts. When shipped, each bearing is accompanied by documented evidence of compliance with dimensional and functional specifications. A tally sheet backed up by gage traces shows the actual dimensions of inner ring and outer ring of each bearing, all accurate within 20-millionths of an inch. This tolerance, a maximum, is usually bettered, with dimensions often held within 5 or 10 millionths.

PROTOTYPES AVAILABLE

Prototype quantities of 20-Millionths angular contact bearings are now available; .250000" bore, .625000" O.D. in two .000020" calibration groups for bores and O.Ds. For further information, ask for 20-Millionths Booklet TWM.

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RELEASES

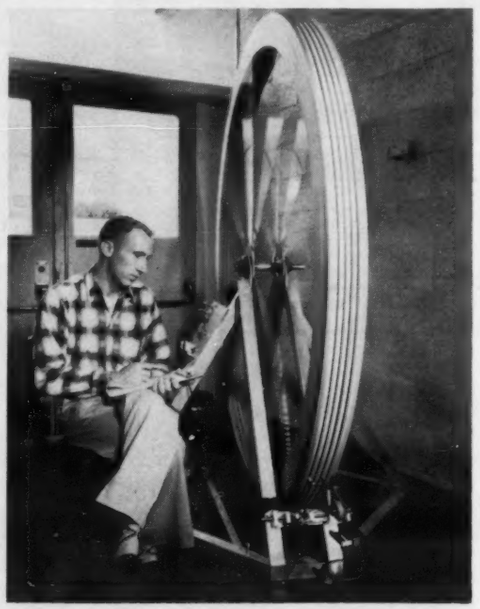
• **LOOP ANTENNAS,** 6½ ft in dia and containing 32,000 turns of nylon-coated copper wire, will be used by the Central Radio Propagation Laboratory, National Bureau of Standards, Boulder, Colo., to collect data on the behavior of micropulsations and to discover how they can be related to unusual manifestations of solar or magnetic activity.

On the rim of each loop antenna, in four separate channels, are wound 130 miles of copper wire. Wire is covered by a layer of copper screening and finally the entire antenna is coated with fiber glass for protection and waterproofing. Sensitive enough to respond to faint, ultralow-frequency electromagnetic waves or micropulsations, antenna will be used to study oscillations in the broad range of periods from 200 to 0.1 sec, which can be observed on a world-wide basis.

Signals now under most intensive study by the Bureau are oscillations from 5- to 3-sec periods. These micropulsations have been known to the scientific world since 1861, but little is understood about their origin or why the oscillations occur as they do.

Permanent micropulsation installations, using one antenna each, are being established near Boulder, Colo.; College, Alaska, and Huancayo, Peru.

Results of this program, only recently begun, are expected to provide further useful information about ionospheric disturbances arising from extraterrestrial sources which may affect radio communications.



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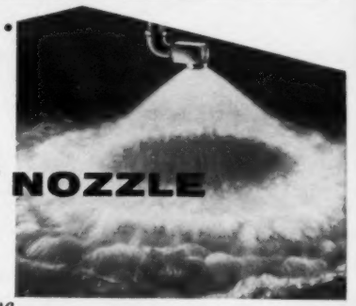

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For almost every spraying application, there's a Spraying Systems Data Sheet that gives useful information on suggested installations and types of nozzles to use. If you have a problem, write and let us know the application involved . . . and we'll send the Data Sheet that applies.

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And . . . for complete spray nozzle information, write for Catalog 24.

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- **Variable speed pulleys with exclusive cam and cam follower feature that assures constant speed regardless of load variations. Ratios to 2.6 to 1. Fractional to 2½ hp.**
- **Wide V-belt variable speed pulleys with cam and cam follower feature as above. Speed ratios to 3 to 1. Fractional to 3¼ hp.**
- **Hi-Ratio variable speed pulleys for economy and exceptional efficiency at speed ratios as high as 7 to 1.**
- **Dual ratio compound drives to provide a compact unit for obtaining speed ranges not possible with a single pulley.**
- **Motor bases in a full range of types and sizes: adjustable, tilting and movable countershaft. Also motor frames.**
- **Wide V-belt sheaves and wide variable speed belts, sizes from .087 to 14**

You'll find the answer to any vari-speed application in Hi-Lo's complete line. Ask for recommendations on your requirement. Request Bulletin H-61

Manufactured By HI-LO MANUFACTURING COMPANY
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4962-H West Lake St.
Chicago 44, Ill.

Circle 106 on Reader-Service Card

OBSERVER sees what appears to be two merging "blips", representing airplanes about to collide on his conventional "flat" radar screen. "Stereoscan" display screen shown on right clearly shows altitude separation of two airplanes.

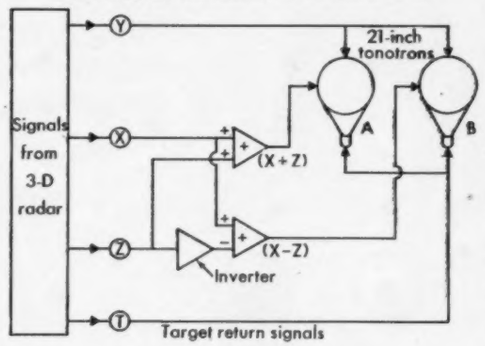
• **3-D RADAR** presents a progressive picture of the trails of aircraft under surveillance by an operating radar.

The display, called "Stereoscan", provides depth perception, enabling the viewer to distinguish altitude separation between target trails as well as their range and bearing.

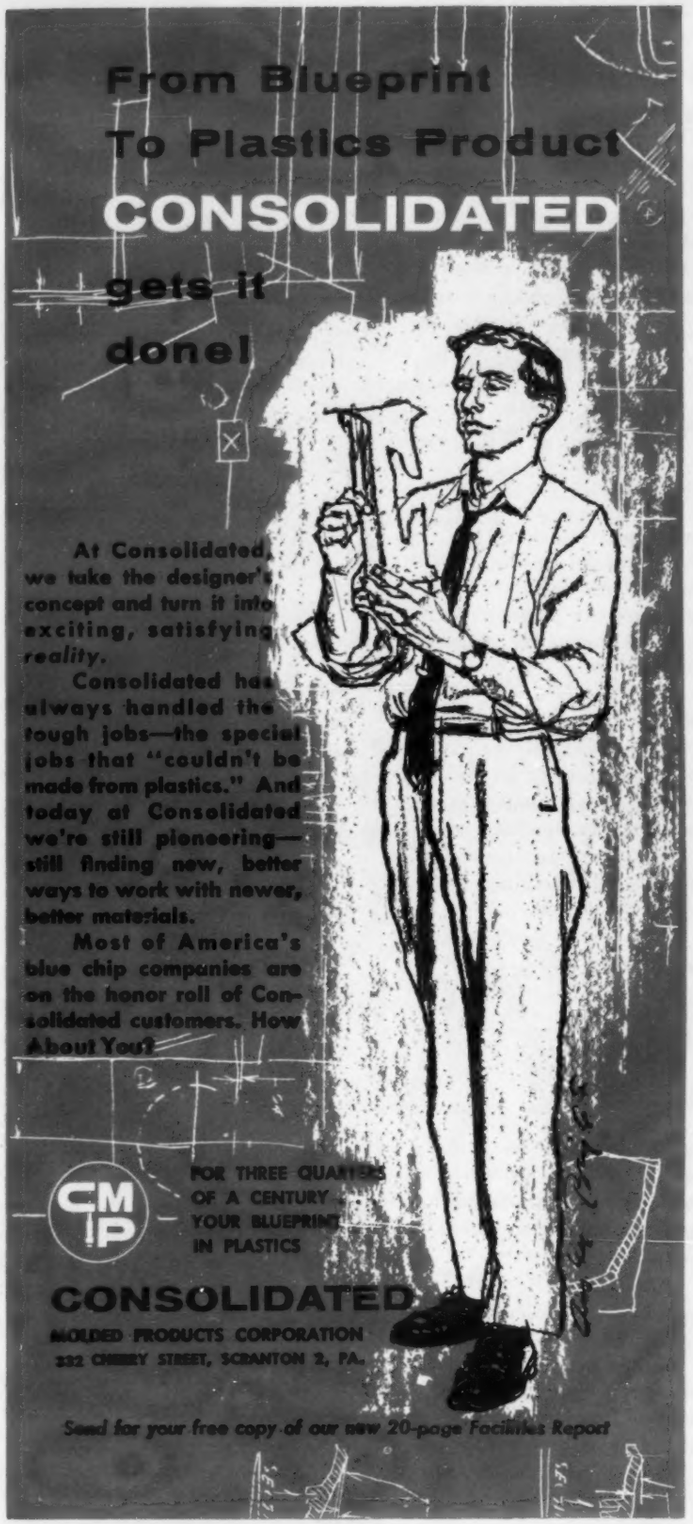
Operators wearing polarized glasses are able to distinguish differences in altitude between merging targets which, in a flat or two-dimensional display, would appear to be approaching collision.

"Stereoscan" was developed by Hughes Aircraft Co., Malibu, Calif.

OPERATION OF 3-D DISPLAY WITH 3-D RADAR



WIRING SKETCH indicates how 3-D radar, "Frescan", provides vital aircraft pinpoint position information (range, bearing and altitude) to give electronic air traffic display (Stereoscan). A and B are 21-inch dia direct-view storage display tubes. X and Y are sawtooth deflection potentials. Z is time-varying voltage, proportional to the sine of antenna elevation angle. T represents target return signals. By adding Z voltage to X deflection voltage of tube A, and subtracting same voltage from that of tube B, a visual parallax proportional to target height is provided; thus, the display may be seen in depth, or three dimensions.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At Consolidated, we take the designer's concept and turn it into exciting, satisfying reality.
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RELEASES

• **TECHNICAL SERVICES DIV.** of Rogers Publishing Co., Denver, Colo., producer of the product data storage and retrieval system called VSMF, The Microfilm Catalog File, has been set up as an independent company.

The new name of the firm is Information Handling Services, Inc. It will remain at its present location in Denver.

Introduced to the industry just one year ago, the VSMF system is now one of the primary sources of product information in virtually every major aerospace plant in the nation and in many major electronics firms.

In its first year of operation VSMF saved the aerospace and electronics industries between $20,000,000 and $30,000,000 by reducing the time that engineers, purchasing agents and others spend searching for product information.

Key to the VSMF system is a copyrighted, cross-referenced index which permits the user to locate a product no matter how it occurs to him to look it up.

The VSMF system now contains more than 70,000 pages of vendor product information from more than 1800 suppliers to the industry.

Richard H. O'Brien, vice-president and general manager of Technical Services, will continue as chief executive officer of the new firm and has been named president.

Custom Quality

OHIO COLD DRAWN

features improved physicals, closer tolerances, better finish

Arrows indicate approximate center of weld line. After normalizing, cold drawing and annealing, the weld area cannot be detected even when the polished and acid-etched surface is magnified 100 diameters. This perfect microstructure makes Ohio Drawn-Welded, in every sense, weldless — an ideal tubing for critical mechanical and pressure applications. In addition to cold drawing, a severe test in itself, non-destructive tests such as air, water, magnetic and eddy current, insure 100% acceptability.

A-4363A

Circle 107 for Reader Service

WELDED STEEL TUBING

Now Available in Larger Sizes... Heavier Wall Thicknesses

NEWS ITEM:

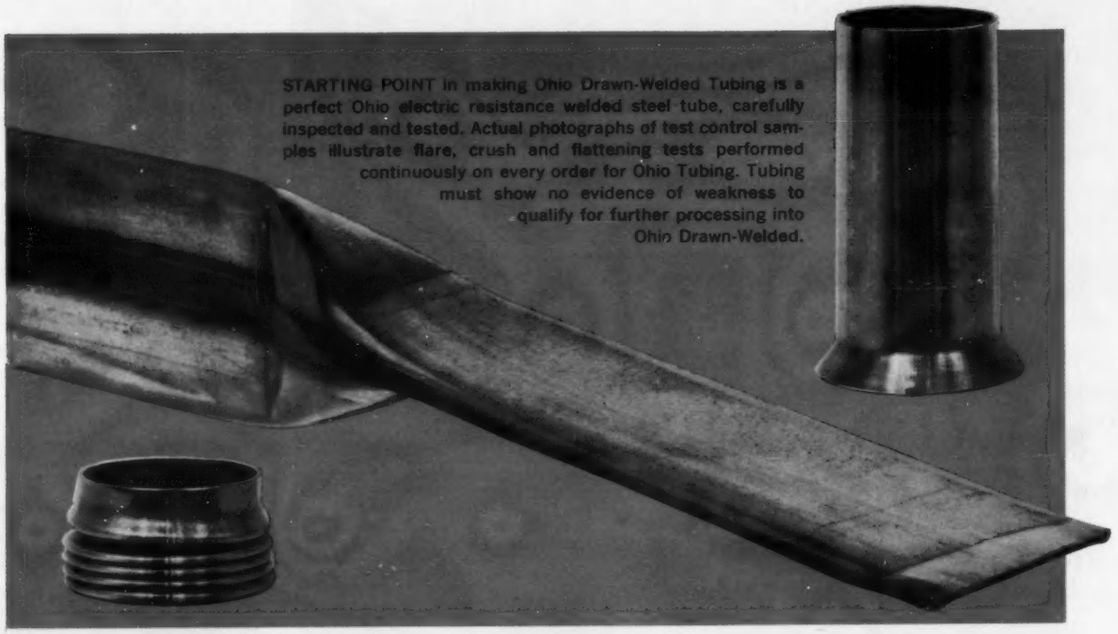
Ohio Seamless is now cold drawing quality electric resistance welded steel tubing up to 7¼ inches with wall thicknesses to .344. Ohio Custom Made Drawn-Welded Tubing is here now — in greater range of sizes, wall thicknesses, finishes than ever before.

TECHNICAL ITEM:

Controlled normalizing assures desired microstructure . . . Precision cold drawing imparts special physical properties, assures uniform wall thickness, delivers closer dimensional tolerances and superior surface finish.

ACTION ITEM:

This all adds up to a new major-source capability that can help you design with new freedom, manufacture at lower costs. Mark your orders: Ohio Custom Made Tubing. Either welded or seamless, it's your best buy whenever tubing is the best shape.



STARTING POINT in making Ohio Drawn-Welded Tubing is a perfect Ohio electric resistance welded steel tube, carefully inspected and tested. Actual photographs of test control samples illustrate flare, crush and flattening tests performed continuously on every order for Ohio Tubing. Tubing must show no evidence of weakness to qualify for further processing into Ohio Drawn-Welded.

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Division of Copperweld Steel Company • **SHELBY, OHIO**

Seamless and Electric Resistance Welded Steel Tubing • Fabricating and Forging

Representatives in principal cities. Check leading directories:
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See us at the* DESIGN ENGINEERING SHOW — *Cobo Hall, Detroit — May 22-25

• SECONDS DIVIDED INTO MILLIONTHS is the recent, most highly accurate system to join the family of sundials, hour glasses, grandfather clocks and wrist watches. The new system can break down seconds to parts in millionths and, at the same time, synchronize clocks to its ultraprecise standard.

The National Bureau of Standards has added the equipment to its already precise measurement facilities at Boulder, Colo. Before the new development, widely-separated clocks could be synchronized only in thousandths of a second.

This significant advance in timing technique has been made possible by the Loran-C (LOng RAnge) Navigation) system developed and produced by Sperry Gyroscope Co. Until now, Loran-C has been employed mainly to supply accurate navigation information to both ships and airplanes.

Although doubtful that a microsecond hand will replace a second hand on everyday watches, the Bureau believes the development holds great promise for both military and civilian projects.

The timing system, for instance, could greatly advance the techniques of weather forecasting by precisely measuring lightning flashes to determine the exact location of thunderstorms.

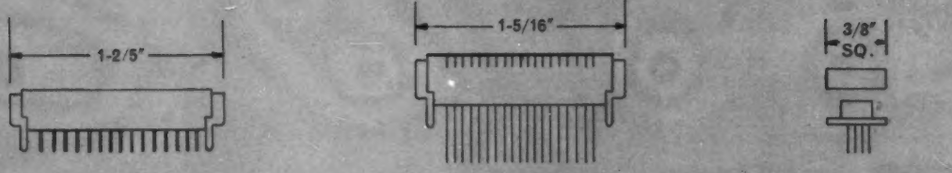
It also could be used to detect space vehicles and aircraft, as well as synchronize sensing devices monitoring all-important missile tests and to survey offshore islands and remote areas with extreme exactness.

The Bureau pointed out that a satellite traveling at an escape velocity of 25,000 fps could be miles away from its indicated position if separate tracking clocks disagree by only a fraction of a second.

Circle 107 on Reader-Service Card

THESE ARE MICROMINIATURE CONNECTORS—
4 TIMES ACTUAL SIZE!

DIMENSIONS (ACTUAL SIZE)



Micro Edge
64 SERIES

Micro Min
74 SERIES

Micro Mod
96 SERIES

RELEASES

• **WORLD'S LARGEST ANTENNA INSULATORS** with especially designed, sleet-melting circuits are now in operation at the U. S. Navy's VLF (very low frequency) radio transmitting station near Cutler, Me.

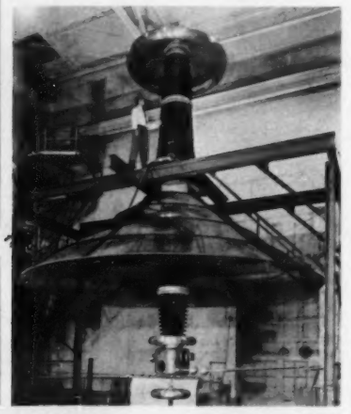
Developed and manufactured by General Electric's Insulator Dept., Baltimore, Md., the 26-ft-high insulator bushings carry antenna lead-ins through roof of helix housing and insulate antenna trunks from the buildings.

Culminating three years of research and development, the 8500-lb insulator bushings are rated 300 Kv and permit from 180 to 300 Kv to pass through bushing to antennas.

Tests performed proved the giant insulator to be corona free when operating at 500 Kv, 60-cycle a-c.

A special de-icing circuit keeps the radio station on the air at all times. This circuit features a 500-lb disconnect switch, located at the base of each bushing, to feed radio frequency and provide an unprecedented switching arrangement for melting ice on antenna cables.

After switching the circuit off the air, 800 amps at 4160v at 60-cycle a-c are passed through antenna cables to melt ice formations.



Circle 108 on Reader-Service Card

TINY ELECTRIC CELLS are used in testing electrical systems. At left is the highly accurate saturated standard cell, while at right is the working, or unsaturated, standard cell.

• **"UNSATURATED STANDARD CELLS"**, used in measuring accurately the voltage in an electrical system, will be calibrated by the Baltimore Div. of the Martin Co.

Martin has taken great interest in metrology because of the extremely accurate measurements needed in the construction and flight of missiles and space vehicles.

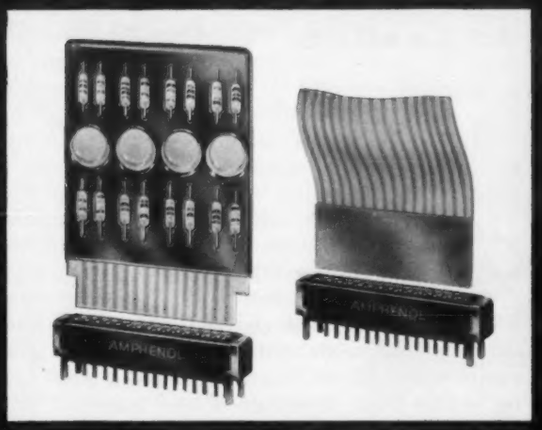
The urgency of developing U. S. capabilities in metrology is exemplified by Russian achievements in the field. Soviet scientists in 1956 could make calibrations of temperature-measuring devices up to 6000C. The U. S. in 1956 could calibrate temperatures up to only 2800C, and even today our scientists have advanced to calibrations of only 4200C. The Russians, however, claim they have extended their competence to 12,000C.

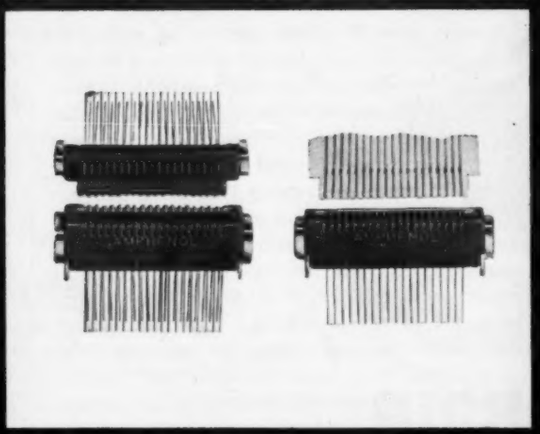
The "H"-shaped standard cells —about 3 inches long by 1⅜ inches wide—are used in metrology research and in the calibration of specialized instruments.

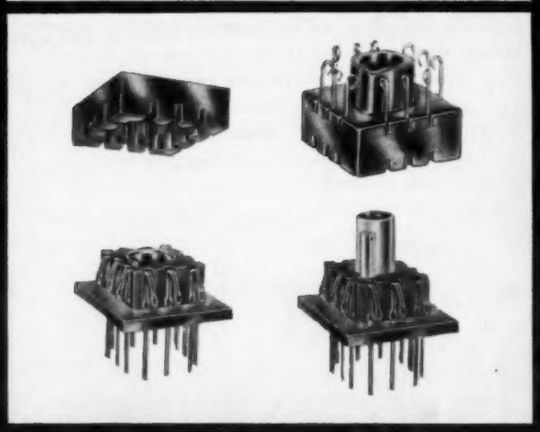
Martin, already employing people skilled in metrology, was selected by the National Bureau of Standards for the undertaking because it has a number of saturated standard cells in which the mercury-based electrolytic solution is saturated with cadmium sulphate crystals. These are required to calibrate the unsaturated standard working cell which has cadmium sulphate in ordinary solution.

The saturated cell's accuracy can be calibrated to within 0.001 percent while unsaturated type has an accuracy of 0.01 percent. Both produce between 10 and 100 microamps (a millionth of an ampere) of current.

Circle 109 on Reader-Service Card







Micro Edge

Receptacle for flexible printed wiring or printed circuit boards. 15 contacts on .075" centers, with 2 lines of interference per circuit.

Micro Min

19 contact receptacle with mating components mounting board or 38 contact rack & panel/modular pair. Contacts on .050" centers.

Micro Mod

12 contacts on .075" centers. 2 types available for either modular use or for cable-to-cable, cable-to-chassis or board-to-chassis usage.

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AMPHENOL CONNECTOR DIVISION

Amphenol-Borg Electronics Corporation

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☐ *Send me full information on Micro Edge, Micro Min and Micro Mod*

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NEW 15,000-lb Pressure Switch FOR HYDRAULIC SYSTEMS

Built for Tough Industrial Service—

Wide range of pressures • adjusts from 2,000 to 15,000 psi on rising pressure

Strain relief • prevents damage from shock of violent pressure surge

Oil-tight construction • gasketed construction prevents entry of oil and coolant into switch mechanism

Rugged snap-action switch • one or two pole—permits operating rates up to 300 per minute

Long life • pressure element not subject to fatigue

Low maintenance • indestructible piston, rugged metal case, long-life switching member, range-locking nut

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SQUARE D COMPANY

wherever electricity is distributed and controlled

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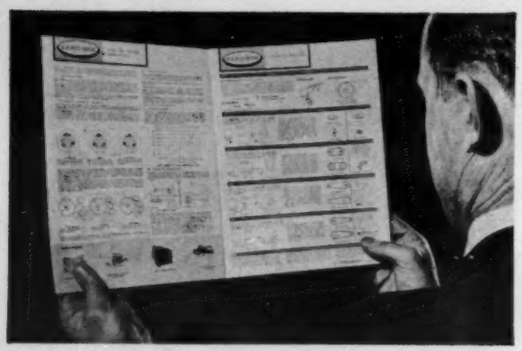

free information

STEPLESS VARIABLE SPEED

This 16-page catalog gives you all you need to know about fhp variable speed problems. It also describes over 30 basic models of fractional horsepower variable speed drives which are available with or without motors, gearheads and reverse.

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RELEASES

• **GLASS-TO-METAL** attachment developed for high-performance aircraft windshields was demonstrated at Corning Glass Works when it was used to lift a truck trailer weighing 6½ tons.

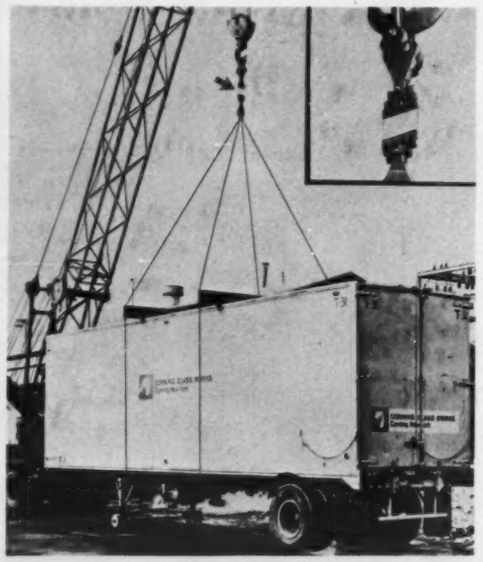
The glass used was 6- by 6- by ⅜-inch polished and tempered Corning Code 1723 aluminosilicate glass. A "Narmco" adhesive, "Metlbond 302", bonded "Kovar" metal members to the edge of the glass. Total weight of the trailer and support rigging was 13,728 lb, which represented a loading of 2288 lb per linear inch of bond line.

Controversy over the design lies in that it deliberately transfers tensile loads to the glazing by means of bonded side members. This is a concept accepted by some engineers but rejected by others.

The attachment by which the trailer was lifted, known as the Type 3 edge attachment, used "Kovar" because its linear expansion is fairly close to that of the Corning 1723 glasss between —65 and 500F, the operating range called for under the Air Force contract. "Metlbond 302" was chosen because of its shear properties at temperatures to 500F. The "Kovar" was a single piece, milled by acid etching and stepped on each side toward the center of the glazing.

Specimens of a beam configuration, 3 by 15 by ½ inch, with bonded attachments at each end, were bolted to rigid, nonrotating supports, to evaluate the effect of the bonded edges in providing simulated end fixity. An average failing load equivalent to a uniform pressure load of 71.6 psi was recorded, as compared to 52.2 psi for a simply-supported, unbonded beam.

The Air Force contract with Corning specified development of windshields capable of withstanding flight conditions that would produce temperatures to 900F.



LOCK OUT AIR FOR MACHINE REPAIR

Ross

Locks
Out and
e**X**hausts
VALVE

Lock out air that operates a machine, as a safeguard when making machine repairs. The Ross L-O-X Valve installs in the supply line leading to the machine, upstream of any operating valve. Designed so that when closed, supply-air to the machine is shut off and air downstream is exhausted. Can be padlocked in this position.

More L-O-X valves can be incorporated in the circuit to shut off and exhaust various segments of the circuit. Detented open; very low pressure drop; Lightweight aluminum construction. Call your Ross representative or write for literature.

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106 EAST GOLDEN GATE AVE. • DETROIT 3, MICH.

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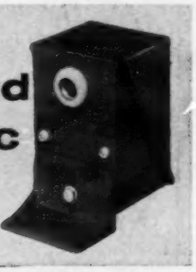
Transistorized Photoelectric Controls



small remote sensing and light source heads—two of the many items described in the complete catalog.

Built to heavy duty industrial standards. Conservative design provides wide margin of reliable operation, beyond normal variations in line voltage.

Available with self-contained or remote sensing heads and with a wide selection of light sources to meet widely varying application needs.

Complete catalog describes extensive line of transistorized and conventional photoelectric equipment—also includes diagrams of widely varied applications.

Send for catalog or tell us what you want to do.

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Hickory 6-0650 TWX: DANV ILL 7338

Representatives in principal Cities

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OUTBOARDS

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For maximum power output . . . efficient carburetion and cooling . . . tight lubricant retention and water exclusion . . . Scott Outboard Motor engineers specify these typical high-quality Victor gaskets and oil seals:

- **VICTOCOR®** soft-packing, metal-core, cylinder head gasket
- **VICTOPLATE** fiber and synthetic rubber shim gasket
- **CORBESTOS®** steel-core asbestos power head adapter gasket
- **VICTOPAC®** asbestos-synthetic rubber cover plate gasket
- **ASBESTOPAC®** asbestos-synthetic rubber drain cover gasket
- **VICTORITE®** treated plant-fiber packing carburetor adapter gasket
- **Type K31 VICTOPRENE®** limited-space application oil seal for water and bailer pumps
- **Type K4 VICTOPRENE®** dual-lip oil seal for propeller shaft and crankshaft

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• **A SOLID PROPELLANT** that will reduce the weight of rocket motors and increase energy output approximately six percent is the C-123 formula, utilizing a mixture of "Hycar" man-made rubber with high-energy compounds.

Development tests have shown that this most advanced formula has a 15-lb-sec increase in impulse over present rubber-based fuels, This represents approximately six percent more energy.

The propellants classified in the Nitro C-rubber group are reported to be superior to the nitrocellulose-containing propellants in aging stability, in ballistic and mechanical properties over a wide temperature range from —110 to 250F, and in other bonding and handling characteristics.

The high-energy fuel has important applications in antiaircraft missiles, the upper stages of ballistic missiles and high-mass-ratio motors for space probe and satellite missions. "Hycar" rubber used in the manufacture of solid propellants is supplied by B. F. Goodrich Chemical Co.

Meetings

Pittsburgh, Pa. June 4-8	ANNUAL MEETING, American Nuclear Society, Penn-Sheraton Hotel.
St. Louis, Mo. June 4-9	SUMMER MEETING, Society of Automotive Engineers, Chase-Park Plaza Hotel.
New York, N. Y. June 5-9	NATIONAL PLASTICS EXPOSITION AND CONFERENCE, Society of the Plastics Industry, New York Coliseum and Commodore Hotel.
Los Angeles, Calif. June 11-14	SUMMER ANNUAL MEETING, American Society of Mechanical Engineers, Statler Hilton Hotel.
Ithaca, N. Y. June 13-16	INDUSTRIAL ENGINEERING SEMINAR, Sibley School of Mechanical Engineering, Cornell University.
Philadelphia, Pa. June 14-15	FIFTH NATIONAL CONFERENCE ON PRODUCT ENGINEERING AND PRODUCTION, Institute of Radio Engineers, Sheraton Hotel.
Chicago, Ill. June 14-16	APPLIED MECHANICS CONFERENCE, American Society of Mechanical Engineers, Illinois Institute of Technology.
Estes Park, Colo. June 22-23	EIGHTH ANNUAL SYMPOSIUM ON COMPUTERS AND DATA PROCESSING, Denver Research Institute, University of Denver, Elkhorn Lodge.

HIGH GRIP STRENGTH

Exerting a "squeeze" between parts up to 600 pounds without distortion or danger of stripping, "POP" Rivets are ideal for every fastener application that calls for high grip strength combined with fast, economical setting. Equally important, you can always be sure of dependably high fastening quality and completely uniform clinching action, because the grip strength of "POP" Rivets depends on the carefully controlled breaking point of the setting mandrel . . . not on the strength or skill of your operators.

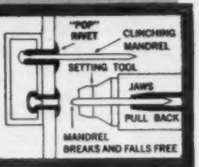
Remember, uniformly high grip strength with dependable fastening quality is just one of the one dozen reasons why "POP" Rivets run rings around the rest. If you're interested in improving the quality, appearance and sales appeal of your products . . . and reducing costs at the same time . . . be sure to investigate all the reasons that make "POP" the first choice for modern fastening. Write today for complete details and the name of your local "POP" Distributor.

Genuine "POP" Rivets Are Available Through a Large Network of Distributors Throughout The Country.

UNITED "POP" RIVETS

HERE'S HOW THEY WORK

"POP" Rivets are inserted and set from the same side: (1) Rivet is inserted in the work. (2) Jaws of the easy-to-use setting tool grasp the mandrel. (3) Tool is operated. Jaws pull back. Rivet is set. Mandrel breaks and falls free.



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1525 River Road, Shelton, Connecticut, U.S.A.

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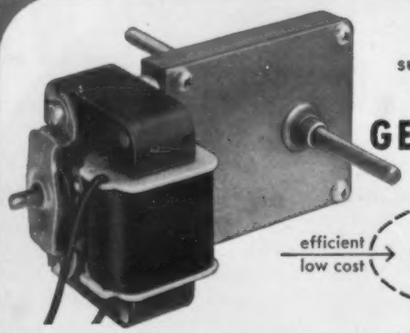

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sub-fractional h.p.
WORM DRIVE
GEAR MOTOR
TYPE WGM

efficient low cost → exceptionally QUIET operation

A two-pole, shaded pole AC induction motor with totally enclosed die cast gear-reducer. Available for 6 to 220 volts, 50 or 60 cycle AC. Gear-reducer speeds, ½ to 300 rpm. Output torque up to 50 inch lbs. at ½ rpm. Precision worm drive. Output shafts, 3/16", ¼", 5/16", ⅜". Mounts in any position. Ideal for motorized office equipment, revolving displays, vending machines, remote TV tuning, etc. Optional: solenoid brake for fast stopping; overload thermal protection; varnish impregnated stator; stainless steel or plated shafts.

We custom-design motors up to 1/40 h.p.; 6 to 220 v., 50 or 60 cycle; ½ to 800 rpm.; torque up to 200 inch lbs. Special gear-reducers designed to your requirements at low cost. Send for details.

Molon Motor & Coil Corp.
3737 Industrial Avenue • Rolling Meadows, Illinois
Custom Designers and Manufacturers of Sub-Fractional Horsepower Motors and Gear-Reducers

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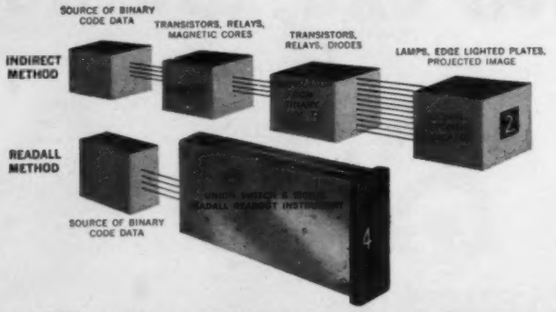
READALL READOUT NEWS from Union Switch & Signal



READALLS® reduce equipment requirements . . . simplify circuitry in industrial control systems

A comparison of the two methods of displaying information reveals the advantages of READALL Readout Instruments. Method A shows a system which requires the use of complicated conversion equipment to bring about a visual display of desired data. Method B eliminates the need for associated conversion units. The additional equipment required in Method A increases initial equipment costs as well as installation and maintenance costs. Use of READALL Readout Instruments makes it possible to eliminate the "black boxes" ordinarily required for use with more indirect readout methods.

Outstanding features in one small package: Readability of display. Binary decoding. Data storage. Electrical readout.

UNION READALL Readout Instruments are available in 10, 12, and 64-character units. Special militarized 12 and 64-character units have been designed specifically for MIL-E-5422D.

Write for Bulletin 1057.

UNION SWITCH & SIGNAL
DIVISION OF WESTINGHOUSE AIR BRAKE COMPANY
PITTSBURGH 18, PENNSYLVANIA

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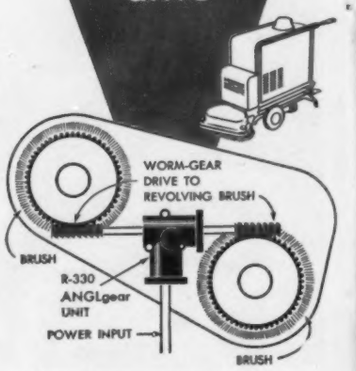
ANGLgear simplifies power-brush drive



Cutaway shows use of 1 hp ANGLgear in brush head of LAWLORmatic 26 in. electric floor scrubber. Company employs ANGLgear in several of its other models as well.

S. C. Lawlor Co., Chicago, Ill., selected ANGLgear 90° drives for the scrubber/buffer heads of its power floor cleaners for these reasons: (1) compactness—helps cut weight and bulk; (2) high capacity—hardened bevel gears transmit more hp; (3) permanent lubrication—saves on maintenance; (4) sealed housing—eliminates possible fouling by wax or detergents.

If you have a similar 90° power take-off requirement, ANGLgear probably offers the simplest, most economical solution. Available immediately from stock, these standardized right-angle drives are easily incorporated in your power transmission systems* because of their compactness and universal mounting feature.

**Design templates free on request*

You can specify ANGLgear in ⅓, 1, 2¼ and 5 hp ratings with 1:1 or 2:1 gearing and 2 or 3-way shafting. Send for Catalog IA-58 or contact our local distributor.

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Engineered Equipment for Aircraft and Industry
AIRBORNE ACCESSORIES CORPORATION
HILLSIDE 5, NEW JERSEY

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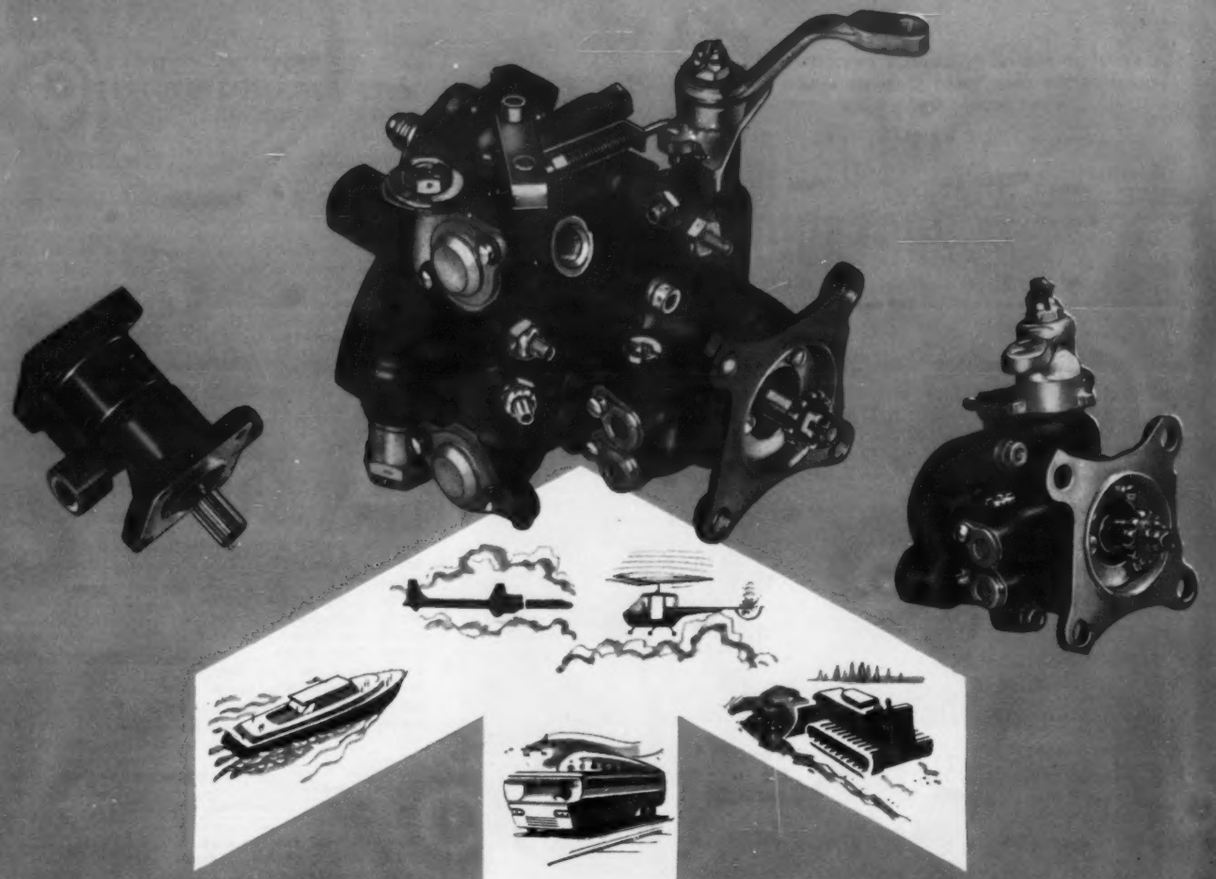

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Bendix control systems are available for aircraft, industrial, ground vehicle, and marine fixed shaft and free turbine engines.

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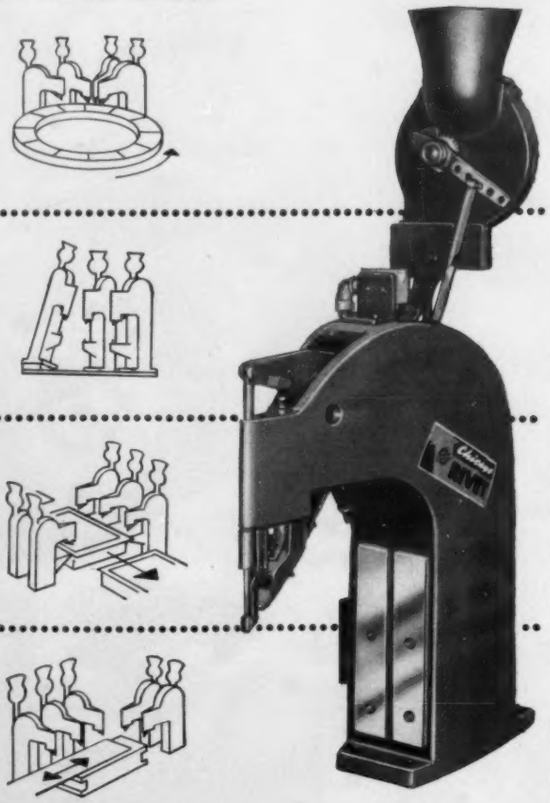
A FEW OF MANY POSSIBLE RIVETING HEAD POSITIONS THAT CAN BE USED



Rotating fixture showing suggested arrangement of riveting heads.

Riveting heads can be positioned for fastening on flat or curved assemblies.

Conveyor Belt permits multiple setting on both sides of an assembly.

Sliding fixture used for riveting 2 sides of an assembly.

AUTOMATE RIVET SETTING

for new low costs

For years assemblies made of metal and non-metal or a combination of both have been fastened most economically with semi-tubular rivets. And now even lower costs are possible with the thin-nose riveting heads designed by Chicago Rivet. These heads, pneumatically operated but electronically controlled, can be grouped in clusters on one or more planes and will set rivets as close as $^{13}/_{16}$" apart. Automation, thru rotating sliding or continuous belt feeding and riveting stations, is possible. Riveting heads may be repositioned and used again on new assemblies.

CUSHIONED RIVETING REDUCES BREAKAGE

A pneumatic riveter upsets the rivet with a squeezing action which minimizes breakage and automatically compensates for slight variation in assembly thicknesses.

The suggestions of Chicago Rivet fastening specialists will prove most helpful. Call them—no obligation.

AIR-POWERED RIVETING CATALOG contains description and specifications of 8 single and multiple riveters—also rivet setters designed for automation.

RIVET CATALOG describes 1388 standard tubular and split rivets and 25 single and multiple motorized automatic rivet setters.

Chicago Rivet & MACHINE CO.

961 So. 25th Ave., Bellwood, Ill. (Chicago Suburb) • **Branch Factory: Tyrone, Pa.**

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PRODUCT APPLICATION

HANSEN
SYNCHRON
TIMING MOTORS

synchronous power source for

ELAPSED TIME INDICATORS

Hansen SYNCHRON motors being assembled into Hobbs engine hour meters

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The application described demonstrates another way in which Hansen SYNCHRON motors serve as an integral part in product operation. You may be able to profit from such dependable performance applied to your timing application, now being planned or in production. SEND TODAY for informative folder detailing specifications and technical data on all Hansen SYNCHRON Timing Motors and Clock Movements.

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Atoms with Icicles

I wondered why their bid was so low

A cool "atom smasher" operating at temperatures near —400F has been suggested as a means of reducing initial cost and upkeep on these expensive machines.

Dr. Cyril D. Curtis of Midwestern Universities Research Assoc., Madison, Wis., notes that the large magnets used in atom accelerators might be made of such superconducting materials as the niobium-tin alloy recently developed at Bell Telephone Laboratories. This approach would reduce considerably the size of magnets required to achieve a specific energy for particles being accelerated in the machine.

Minimizing Magnetism

If you have magnetic field problems, try the U. S. Naval Ordnance Laboratory. They have an area as free from magnetic fields as scientists can make it. The especially designed building is constructed entirely from nonmagnetic materials, including wood, building mortar from which sand was screened to exclude minute particles of iron oxide, plastic floor drains, aluminum light switches and copper nails.

The building has been used recently to check out the S-3 energetic particle satellite. The S-3 is designed to measure U. S. magnetic fields and cosmic rays and energetic particles trapped in the Van Allen radiation belts encircling the earth.

How much are we paying that man?

More Moon Matters

A thin, electrically charged layer at the moon's surface is helping to smooth out the moon's valleys and ridges.

A sheath of electrons created by bombarding ultraviolet rays of the sun helps transport moon "dust" along the surface of the moon. The dust stops traveling when it falls into a crater or nestles in the shadow of a ridge.

Microscopic meteorites constantly pelting the moon raise a flurry of dust, Dr. S. F. Singer and E. H. Walker of the University of Maryland report. The dust particles acquire a positive charge and are constantly repelled or "bounced" along by the electron layer. They finally lose their energy when they reach the dark side of the moon or a mountain's shadow.

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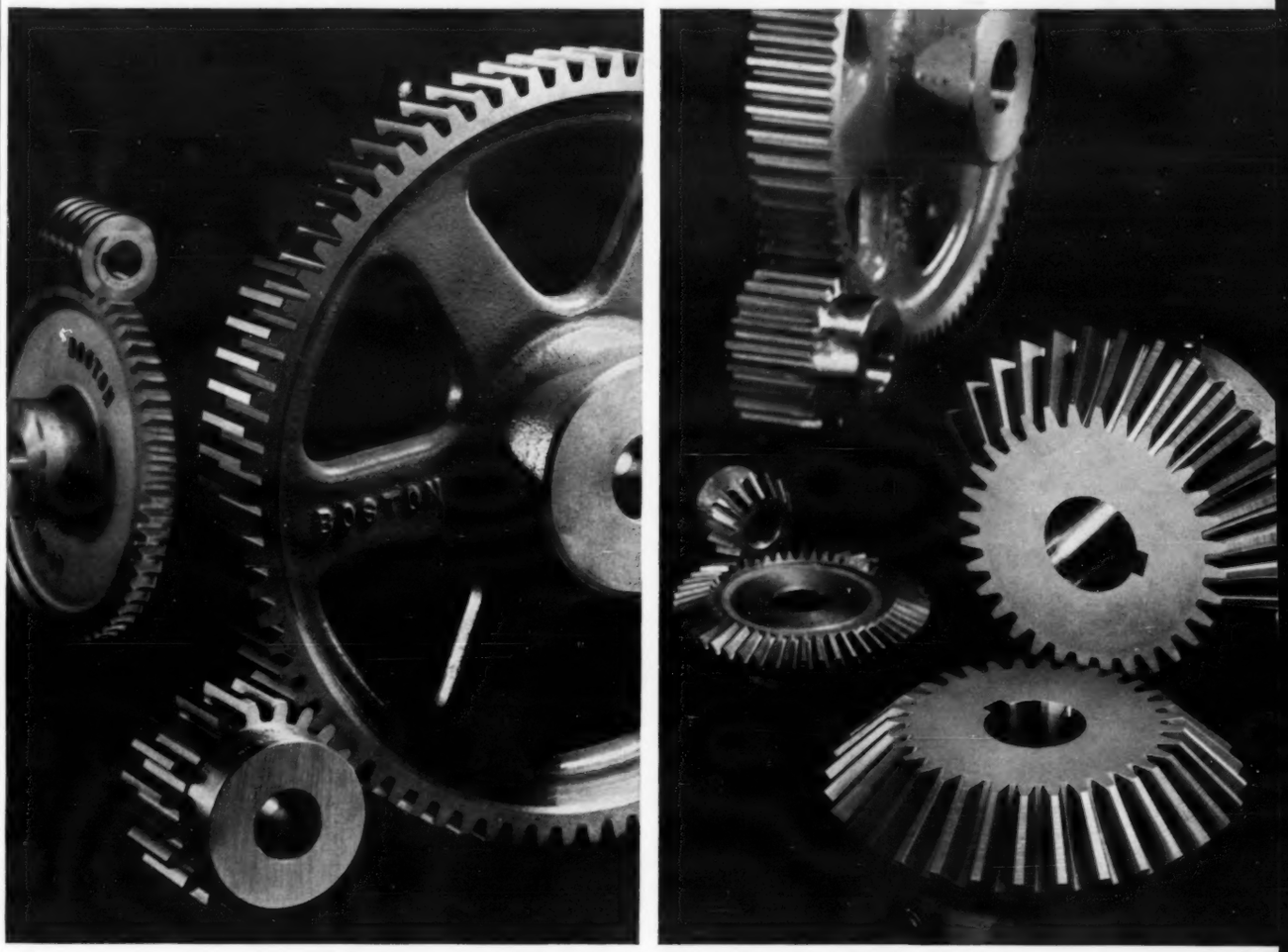

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Brass, steel, iron, nonmetallic. See Catalog 57.

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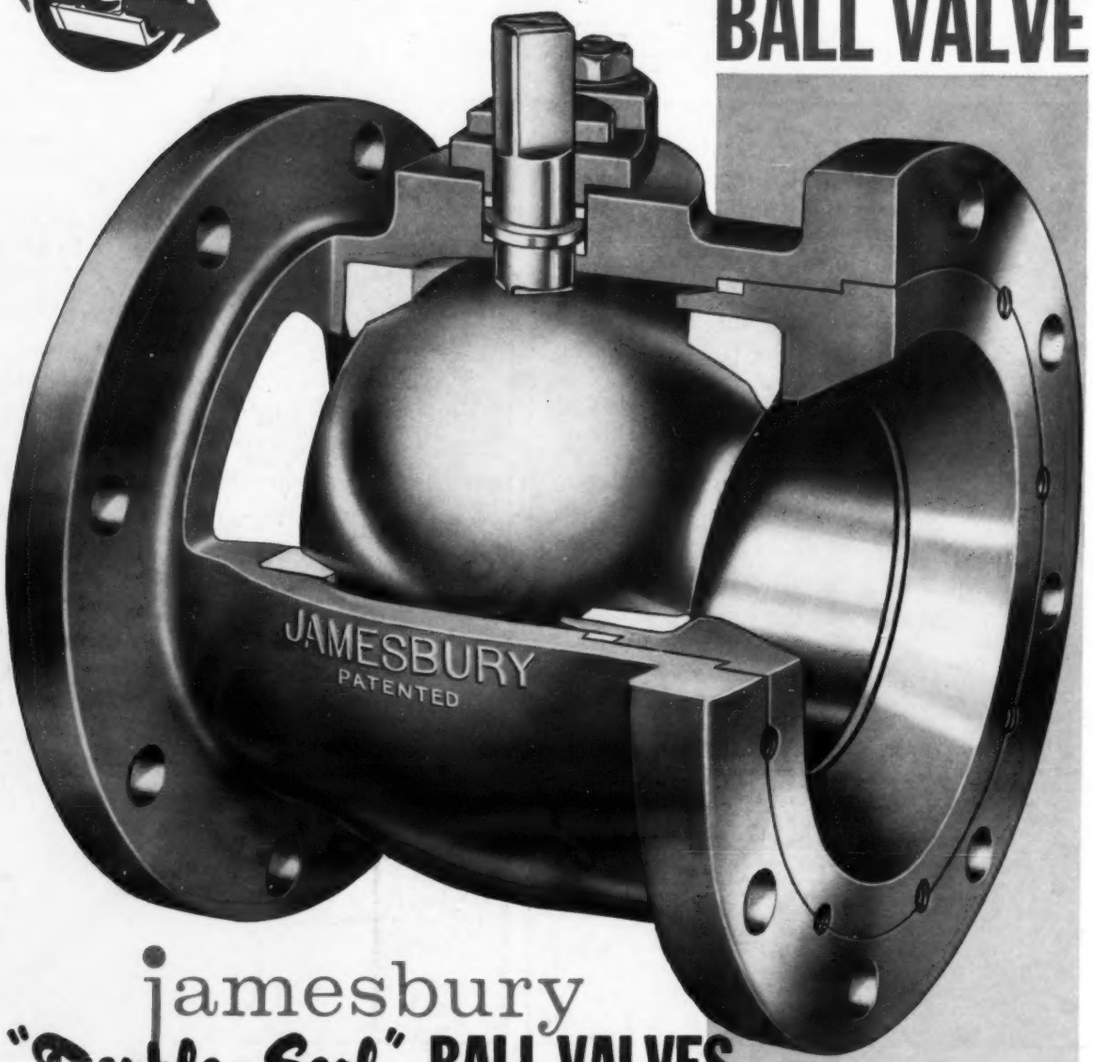

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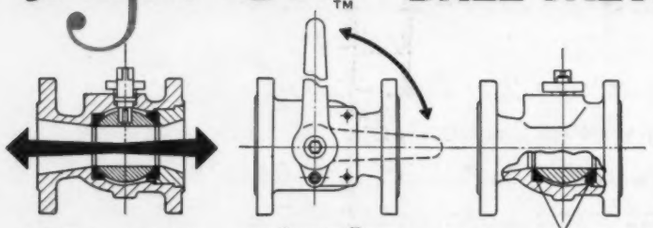

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300# series—½" through 8"*
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